PUBLIC UTILITIES COMMISSION MIXED-USE DEVELOPMENT NOISE AND VIBRATION ASSESSMENT

South San Francisco, California

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Project: 18-189

INTRODUCTION

The project proposes the construction of 809 residential units, 13,000 square feet of commercial space, and a 5,500 square-foot child care center at a site north of Chestnut Avenue, between El Camino Real and Mission Road, in South San Francisco. The project site consists of two parcels (Parcels B and C), which are mostly undeveloped. Two existing Bay Area Rapid Transit (BART) buildings are currently located on Parcel B, and these two buildings would remain under proposed project conditions. On the remaining undeveloped land, three mixed-use buildings, each with eight stories, would be developed. Parcel C, which will include proposed Buildings A and B, would also include one shared underground level for parking. The site would be accessed from Mission Road and Antoinette Lane. As part of the project, the bridge for the Oak Avenue extension would also be constructed. This would occur just south of Mission Road.

This report evaluates the project's potential to result in significant noise and vibration impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into three sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise and groundborne vibration , summarizes applicable regulatory criteria, and discusses the results of the ambient noise monitoring survey completed to document existing noise conditions; 2) the General Plan Consistency Section discusses land use compatibility utilizing policies in the City's General Plan; and, 3) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents measures, where necessary, to mitigate the impacts of the project on sensitive receptors in the vicinity.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (L_{dn} or *DNL*) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Effects of Noise

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn}/CNEL. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn}/CNEL and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA L_{dn}/CNEL with open windows and 65-70 dBA L_{dn}/CNEL if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to

be able to have their windows closed; those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The L_{dn}/CNEL as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 50 dBA L_{dn}/CNEL. At a L_{dn}/CNEL of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the L_{dn}/CNEL increases to 70 dBA, the percentage of the population highly annoyed increases to about 25-30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between a L_{dn}/CNEL of 60-70 dBA. Between a L_{dn}/CNEL of 70-80 dBA, each decibel increase increases by about 3 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the L_{dn}/CNEL is 60 dBA, approximately 30-35 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 3 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 4 percent increase in the percentage of the population highly annoyed.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous or frequent intermittent vibration levels produce. The guidelines in Table 3 represent syntheses of vibration criteria for human response and potential damage to buildings resulting from construction vibration.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to cause damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Human perception to vibration varies with the individual and is a function of physical

setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as paint flaking or minimal extension of cracks in building surfaces; minor, including limited surface cracking; or major, that may threaten the structural integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher. The damage criteria presented in Table 3 include several categories for ancient, fragile, and historic structures, the types of structures most at risk to damage. Most buildings are included within the categories ranging from "Historic and some old buildings" to "Modern industrial/commercial buildings". Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

Railroad and light-rail operations are potential sources of substantial ground vibration depending on distance, the type and the speed of trains, and the type of railroad track. People's response to ground vibration has been correlated best with the velocity of the ground. The velocity of the ground is expressed on the decibel scale. The reference velocity is 1×10^{-6} in/sec RMS, which equals 0 VdB, and 1 in/sec equals 120 VdB. Although not a universally accepted notation, the abbreviation "VdB" is used in this document for vibration decibels to reduce the potential for confusion with sound decibels.

Typical background vibration levels in residential areas are usually 50 VdB or lower, well below the threshold of perception for most humans. Perceptible vibration levels inside residences are attributed to the operation of heating and air conditioning systems, door slams and foot traffic. Construction activities, train operations, and street traffic are some of the most common external sources of vibration that can be perceptible inside residences. Table 4 illustrates some common sources of vibration and the association to human perception or the potential for structural damage.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 p.m. and 7:00 a.m.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 p.m.to 10:00 p.m. and after addition of 10 decibels to sound levels measured in the night between 10:00 p.m. and 7:00 a.m.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

TABLE 3 Reactions of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.25	Strongly perceptible to severe	Threshold at which there is a risk of damage to historic and some old buildings.
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

TABLE 4 Typical Levels of Groundborne Vibration

Human/Structural Response	Velocity Level, VdB	Typical Events (50-foot setback)
Threshold, minor cosmetic damage	100	Blasting, pile driving, vibratory compaction equipment
		Heavy tracked vehicles (Bulldozers, cranes, drill rigs)
Difficulty with tasks such as reading a video or computer screen	90	
		Commuter rail, upper range
Residential annoyance, infrequent events	80	Rapid transit, upper range
Residential annoyance, occasional events		Commuter rail, typical Bus or truck over bump or on rough roads
Residential annoyance, frequent events	70	Rapid transit, typical
Approximate human threshold of perception to vibration		Buses, trucks and heavy street traffic
	60	
		Background vibration in residential settings in the absence of activity
Lower limit for equipment ultra-sensitive to vibration	50	

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, September 2018.

Regulatory Background

The State of California, San Mateo County, and the City of South San Francisco have established regulatory criteria that are applicable in this assessment. The CEQA Guidelines, Appendix G, are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. A summary of the applicable regulatory criteria is provided below.

State CEQA Guidelines. The CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies;

(b) Generation of excessive groundborne vibration or groundborne noise levels; or

(c) For a project located within the vicinity of a private airstrip or an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels.

Pursuant to court decisions, the impacts of site constraints, such as exposure of the proposed project to excessive levels of noise and vibration, are not included in the Impacts and Mitigation Section of this report. These items are discussed in a separate section addressing the project's consistency with the policies set forth in the City's General Plan.

CEQA does not define what noise level increase would be considered substantial. Typically, project-generated noise level increases of 3 dBA L_{dn}/CNEL or greater would be considered significant where exterior noise levels would exceed the normally acceptable noise level standard (60 dBA L_{dn}/CNEL for residential land uses). Where noise levels would remain at or below the normally acceptable noise level standard with the project, noise level increases of 5 dBA L_{dn}/CNEL or greater would be considered significant.

2016 California Building Code, Title 24, Part 2. The current version of the California Building Code (CBC) requires interior noise levels attributable to exterior environmental noise sources to be limited to a level not exceeding 45 dBA L_{dn}/CNEL in any habitable room.

2016 California Building Cal Green Code. The State of California established exterior sound transmission control standards for new non-residential buildings, as set forth in the 2010 California Green Building Standards Code (Section 5.507.4.1 and 5.507.4.2). These standards were not altered in the 2016 revisions. Section 5.507 states that either the prescriptive (Section 5.507.4.1) or the performance method (Section 5.507.4.2) shall be used to determine environmental control at indoor areas. The prescriptive method is very conservative and not practical in most cases; however, the performance method can be quantitatively verified using exterior-to-interior

calculations. For the purposes of this report, the performance method is utilized to determine consistency with the Cal Green Code. Both of the sections that pertain to this project are as follows:

> **5.507.4.1 Exterior noise transmission, prescriptive method.** Wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall meet a composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 when the building falls within the 65 dBA DNL noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway noise source, as determined by the local general plan noise element.
>
> **5.507.4.2 Performance method.** For buildings located, as defined by Section 5.507.4.1, wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level ($L_{eq\ (1\text{-}hr)}$) of 50 dBA in occupied areas during any hour of operation.

The performance method, which establishes the acceptable interior noise level, is the method typically used when applying these standards.

Comprehensive Airport Land Use Compatibility Plan for the Environs of San Francisco International Airport, July 2012. Noise compatibility policies established in this document were designed to protect the public health, safety, and welfare by minimizing the exposure of residents and occupants of future noise-sensitive development to excessive noise and to protect the public interest in providing for the orderly development of SFO by ensuring that new development in the Airport environs complies with all requirements necessary to ensure compatibility with aircraft noise in the area. The intent is to avoid the introduction of new incompatible land uses into the Airport's "noise impact area" so that the Airport will continue to be in compliance with the State Noise Standards for airports (California Code of Regulations, Title 21, Sections 5012 and 5014).[1] The following noise compatibility policies (NP) shall apply to the ALUCP and are applicable to this project:

NP-1: Noise Compatibility Zones. For the purposes of this ALUCP, the projected 2020 CNEL noise contour map from the Draft Environmental Assessment for the Proposed Runway Safety Area Program shall define the boundaries within which noise compatibility policies described in this Section shall apply.[2] Exhibit IV-5 depicts the noise compatibility zones. More detail is provided on Exhibit IV-6. The zones are defined by the CNEL 65, 70 and 75 dB contours.

NP-2: Airport Noise/Land Use Compatibility Criteria. The compatibility of proposed land uses located in the Airport noise compatibility zones shall be determined according to the noise/land use compatibility criteria shown in Table IV-1. The criteria indicate the maximum acceptable airport noise levels, described in terms of Community Noise Equivalent Level (CNEL), for the indicated land uses. The compatibility criteria indicate whether a proposed land use is

[1] In 2002, the San Mateo County Board of Supervisors declared that the Airport had eliminated its "noise impact area," as defined under state law -- California Code of Regulations, Title 21, Sections 5012 and 5014.

[2] URS Corporation and BridgeNet International. Draft Environmental Assessment, Proposed Runway Safety Area Program, San Francisco International Airport, June 2011.

"compatible," "conditionally compatible," or "not compatible" within each zone, designated by the identified CNEL ranges.

- "Compatible" means that the proposed land use is compatible with the CNEL level indicated in the table and may be permitted without any special requirements related to the attenuation of aircraft noise.

- "Conditionally compatible" means that the proposed land use is compatible if the conditions described in Table IV-1 are met.

- "Not compatible" means that the proposed land use is incompatible with aircraft noise at the indicated CNEL level.

NP-3: Grant of Avigation Easement. Any action that would either permit or result in the development or construction of a land use considered to be conditionally compatible with aircraft noise of CNEL 65 dB or greater shall be subject to this easement requirement. The determination of conditional compatibility shall be based on the criteria presented in Table IV-1 "Noise/Land Use Compatibility Criteria."

The San Mateo County Airport Land Use Commission (the C/CAG Board) deems it necessary to: (1) ensure the unimpeded use of airspace in the vicinity of SFO; (2) to ensure that new noise-sensitive land uses within the CNEL 65 dB contour are made compatible with aircraft noise, in accordance with California Code of Regulations, Title 21, Section 5014; and (3) to provide notice to owners of real property near the Airport of the proximity to SFO and of the potential impacts that could occur on the property from airport/aircraft operations. Thus, C/CAG shall condition its approval of proposed development upon the owner of the subject property granting an avigation easement to the City and County of San Francisco, as the proprietor of SFO. The local government with the ultimate permitting and approval authority over the proposed development shall ensure that this condition is implemented prior to final approval of the proposed development. If the approval action for the proposed development includes construction of a building(s) and/or other structures, the local permitting authority shall require the grant of an avigation easement to the City and County of San Francisco prior to issuance of a building permit(s) for the proposed building or structure. If the proposed development is not built, then, upon notice by the local permitting authority, SFO shall record a notice of termination of the avigation easement.

The avigation easement to be used in fulfilling this condition is presented in Appendix G.

NP-4: Residential Uses Within CNEL 70 dB Contour. As described in Table IV-1, residential uses are not compatible in areas exposed to noise above CNEL 70 dB and typically should not be allowed in these high noise areas.

> *NP-4.1: Situations Where Residential Use Is Conditionally Compatible.* Residential uses are considered conditionally compatible in areas exposed to noise above CNEL 70 dB only if the proposed use is on a lot of record zoned exclusively for residential use as of the effective date of the ALUCP. In such a case, the residential use must be sound-insulated to achieve an indoor noise level of CNEL 45 dB or less from exterior sources. The property

owner also shall grant an avigation easement to the City and County of San Francisco in accordance with Policy NP-3 prior to issuance of a building permit for the proposed building or structure.

Table IV-1 Noise/Land Use Compatibility Criteria

	COMMUNITY NOISE EQUIVALENT LEVEL (CNEL)			
LAND USE	**BELOW 65 dB**	**65-70 dB**	**70-75 dB**	**75 dB AND OVER**
Residential				
Residential, single family detached	Y	C	N *(a)*	N
Residential, multi-family and single family attached	Y	C	N *(a)*	N
Transient lodgings	Y	C	C	N
Public/Institutional				
Public and Private Schools	Y	C	N	N
Hospitals and nursing homes	Y	C	N	N
Places of public assembly, including places of worship	Y	C	N	N
Auditoriums, and concert halls	Y	C	C	N
Libraries	Y	C	C	N
Outdoor music shells, amphitheaters	Y	N	N	N
Recreational				
Outdoor sports arenas and spectator sports	Y	Y	Y	N
Nature exhibits and zoos	Y	Y	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N
Golf courses, riding stables, and water recreation	Y	Y	Y	Y
Commercial				
Offices, business and professional, general retail	Y	Y	Y	Y
Wholesale; retail building materials, hardware, farm equipment	Y	Y	Y	Y
Industrial and Production				
Manufacturing	Y	Y	Y	Y
Utilities	Y	Y	Y	Y
Agriculture and forestry	Y	Y *(b)*	Y *(c)*	Y *(c)*
Mining and fishing, resource production and extraction	Y	Y	Y	Y

Notes:

CNEL = Community Noise Equivalent Level, in A-weighted decibels.

Y (Yes) = Land use and related structures compatible without restrictions.

C (conditionally compatible) = Land use and related structures are permitted, provided that sound insulation is provided to reduce interior noise levels from exterior sources to CNEL 45 dB or lower and that an avigation easement is granted to the City and County of San Francisco as operator of SFO. See Policy NP-3.

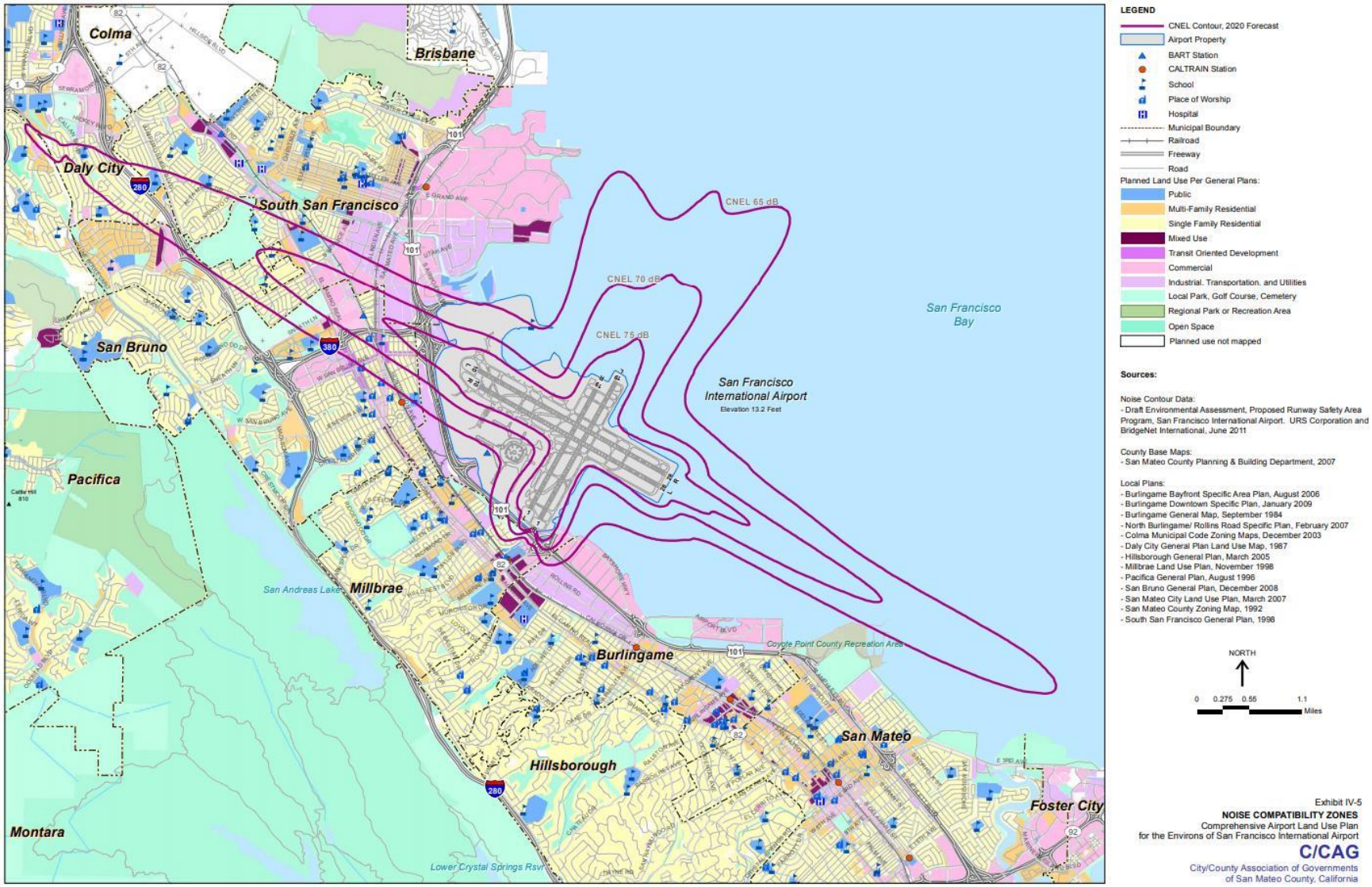
N (No) = Land use and related structures are not compatible..

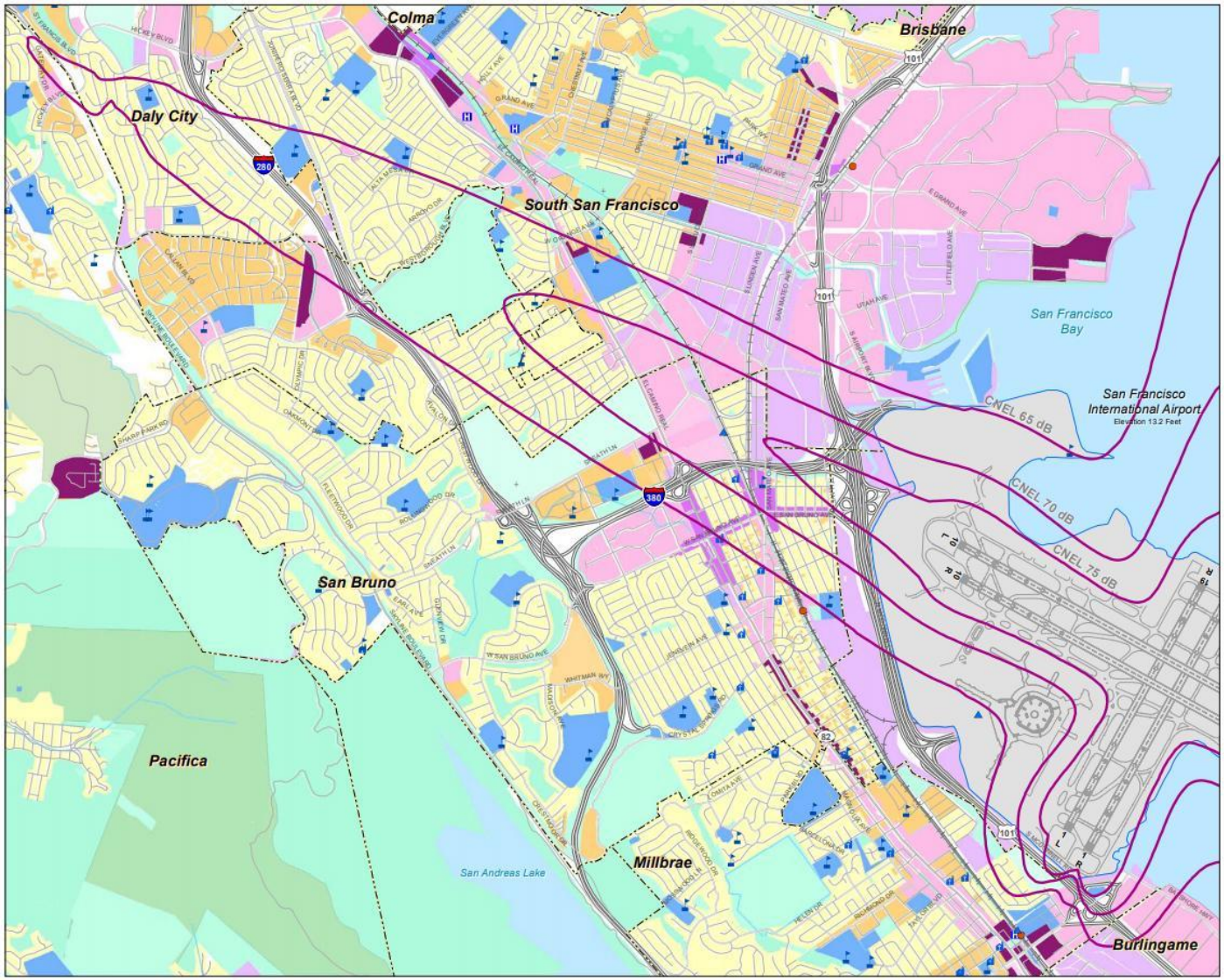
(a) Use is conditionally compatible only on an existing lot of record zoned only for residential use as of the effective date of the ALUCP. Use must be sound-insulated to achieve an indoor noise level of CNEL 45 dB or less from exterior sources. The property owners shall grant an avigation easement to the City and County of San Francisco prior to issuance of a building permit for the proposed building or structure. If the proposed development is not built, then, upon notice by the local permitting authority, SFO shall record a notice of termination of the avigation easement.

(b) Residential buildings must be sound-insulated to achieve an indoor noise level of CNEL 45 dB or less from exterior sources.

(c) Accessory dwelling units are not compatible.

SOURCES: Jacobs Consultancy Team 2010. Based on State of California General Plan Guidelines for noise elements of general plans; California Code of Regulations, Title 21, Division 2.5, Chapter 6, Section 5006; and 14 CFR Part 150, Appendix A, Table 1.
PREPARED BY; Ricondo & Associates, Inc., June 2012.


Colma
Brisbane
Daly City
South San Francisco
San Bruno
Pacifica
Millbrae
Burlingame
San Mateo
Hillsborough
Foster City
Montara
San Francisco Bay
San Francisco International Airport
Elevation 13.2 Feet
CNEL 65 dB
CNEL 70 dB
CNEL 75 dB
San Andreas Lake
Coyote Point County Recreation Area
Lower Crystal Springs Rsvr
LEGEND
CNEL Contour, 2020 Forecast
Airport Property
BART Station
CALTRAIN Station
School
Place of Worship
Hospital
Municipal Boundary
Railroad
Freeway
Road
Planned Land Use Per General Plans:
Public
Multi-Family Residential
Single Family Residential
Mixed Use
Transit Oriented Development
Commercial
Industrial. Transportation. and Utilities
Local Park, Golf Course, Cemetery
Regional Park or Recreation Area
Open Space
Planned use not mapped
Sources:
Noise Contour Data:
- Draft Environmental Assessment, Proposed Runway Safety Area Program, San Francisco International Airport. URS Corporation and BridgeNet International, June 2011
County Base Maps:
- San Mateo County Planning & Building Department, 2007
Local Plans:
- Burlingame Bayfront Specific Area Plan, August 2006
- Burlingame Downtown Specific Plan, January 2009
- Burlingame General Map, September 1984
- North Burlingame/ Rollins Road Specific Plan, February 2007
- Colma Municipal Code Zoning Maps, December 2003
- Daly City General Plan Land Use Map, 1987
- Hillsborough General Plan, March 2005
- Millbrae Land Use Plan, November 1998
- Pacifica General Plan, August 1996
- San Bruno General Plan, December 2008
- San Mateo City Land Use Plan, March 2007
- San Mateo County Zoning Map, 1992
- South San Francisco General Plan, 1998
NORTH
0 0.275 0.55 1.1
Miles
Exhibit IV-5
NOISE COMPATIBILITY ZONES
Comprehensive Airport Land Use Plan
for the Environs of San Francisco International Airport
C/CAG
City/County Association of Governments
of San Mateo County, California



LEGEND

- CNEL Contour, 2020 Forecast
- Airport Property
- BART Station
- CALTRAIN Station
- School
- Place of Worship
- Hospital
- Municipal Boundary
- Railroad
- Freeway
- Road

Planned Land Use Per General Plans:

- Public
- Multi-Family Residential
- Single Family Residential
- Mixed Use
- Transit Oriented Development
- Commercial
- Industrial, Transportation, and Utilities
- Local Park, Golf Course, Cemetery
- Regional Park or Recreation Area
- Open Space
- Planned use not mapped

Sources:

Noise Contour Data:
- Draft Environmental Assessment, Proposed Runway Safety Area Program, San Francisco International Airport. URS Corporation and BridgeNet International, June 2011

County Base Maps:
- San Mateo County Planning & Building Department, 2007

Local Plans:
- Burlingame Bayfront Specific Area Plan, August 2006
- Burlingame Downtown Specific Plan, January 2009
- Burlingame General Map, September 1984
- North Burlingame/ Rollins Road Specific Plan, February 2007
- Colma Municipal Code Zoning Maps, December 2003
- Daly City General Plan Land Use Map, 1987
- Hillsborough General Plan, March 2005
- Millbrae Land Use Plan, November 1998
- Pacifica General Plan, August 1996
- San Bruno General Plan, December 2008
- San Mateo City Land Use Plan, March 2007
- San Mateo County Zoning Map, 1992
- South San Francisco General Plan, 1998

NORTH

0 0.1 0.2 0.4 Miles

Exhibit IV-6

NOISE COMPATIBILITY ZONES -- DETAIL

Comprehensive Airport Land Use Plan
for the Environs of San Francisco International Airport

C/CAG

City/County Association of Governments
of San Mateo County, California

City of South San Francisco General Plan. The portions of the City of South San Francisco's General Plan that apply to this report are as follows:

Guiding Policy 9-G-1: Protect public health and welfare by eliminating or minimizing the effects of existing noise problems, and by preventing increased noise levels in the future.

Guiding Policy 9-G-2: Continue efforts to incorporate noise considerations into land use planning decisions, and guide the location and design of transportation facilities to minimize the effects of noise on adjacent land uses.

Implementing Policy 9-I-1: Work to adopt a pass-by (single event) noise standard to supplement the current 65 dBA CNEL average noise level standard as the basis for aircraft noise abatement programs.

The simultaneous increase in aircraft operations at SFO and decrease in average noise levels resulting from improvements in jet engine technology presents a challenge for South San Francisco. The current 65 dBA CNEL boundary represents an average noise level and provides the basis for FAA noise abatement funding and land use planning controls. As quieter jets cause this boundary to become smaller, FAA funding for retrofitting homes within the 65 dBA CNEL boundary will also decline. At the same time, expected increases in air traffic will result in increased single-event noise occurrences in the city.

As a result, residents in some areas of South San Francisco not included in the 65 dBA CNEL noise contour will be increasingly impacted by the single-event flyover noise. Homes in these areas would not be eligible for noise abatement funding under the current standard. The City should consider adopting a single-event noise standard to complement the existing 65 dB CNEL standard to mitigate the impacts of noise in these areas through land use planning and noise abatement programs.

Implementing Policy 9-I-2: Work to adopt average noise standards for aircraft-based mitigation and land use controls.

A lower average noise standard for aircraft-based noise mitigation and land use controls would address the impacts of aircraft flyovers in areas outside the existing 65 dB CNEL boundary. The current 65 dB CNEL boundary provides the basis for FAA noise abatement funding and land use planning controls limiting noise-sensitive uses. The City should work with the FAA and SFO to determine if the current average noise standard is adequately mitigating the impacts of aircraft noise in South San Francisco.

A lower average noise standard could be used in conjunction with the single-event noise standard proposed in Policy 9-I-1.

Implementing Policy 9-I-3: Pursue additional funding sources and programs for the noise insulation retrofit of homes not completed before the expiration of the Memorandum of Understanding in 2000.

The Memorandum of Understanding between SFO and San Mateo County jurisdictions, and the specific 1991 Agreement for Aircraft Noise Mitigation between the Airports Commission and South San Francisco establishes the parameters for the City's retrofit program. This agreement requires the City to seek federal grants (to be matched by SFO) to retrofit noise-impacted homes constructed prior to 1983 with noise insulation. The Agreement runs out in 2000 and between 1,200 and 1,500 homes will still require retrofitting.

This program is beneficial and has significantly reduced noise-related impacts in residential areas. The City should begin to pursue the extension of the current agreement and possible boundary adjustments to include homes impacted by aircraft noise beyond the 65 dB CNEL limit.

Implementing Policy 9-I-4: Ensure that project applications for all new noise-sensitive land uses (plans and specifications), including hospitals and residential units proposed within the CNEL 60 dB to CNEL 69 dB aircraft noise contour include an acoustical study, prepared by a professional acoustic engineer, that specifies the appropriate noise mitigation features to be included in the design and construction of these uses, to achieve an interior noise level of not more than CNEL 45 dB in any habitable room, based on the latest official SFIA noise contours and on-site measurement data. (Amended by City Council Resolution 31-2010)

Implementing Policy 9-I-5: Ensure that project applications for new noise-sensitive land uses (plans and specifications), including schools and places of assembly, proposed within the CNEL 60 dB to CNEL 69 dB aircraft noise contour include an acoustical study, prepared by a professional acoustic engineer, that specifies the appropriate noise mitigation features to be included in the design and construction of these uses, to achieve an interior noise level of not more than L_{eq} 45 dB for the noisiest hour of normal facility operation. (Amended by City Council Resolution 31-2010)

Implementing Policy 9-I-6: Require that applicants for new noise-sensitive development in areas subject to noise generators producing noise levels greater than 65 dB CNEL, obtain the services of a professional acoustical engineer to provide a technical analysis and design of mitigation measures.

Implementing Policy 9-I-7: Where site conditions permit, require noise buffering for all noise-sensitive development subject to noise generators producing noise levels greater than 65 dB CNEL. This noise attenuation method should avoid the use of visible sound walls, where practical.

Implementing Policy 9-I-8: Require the control of noise at source through site design, building design, landscaping, hour of operation, and other techniques, for new developments deemed to be noise generators.

Implementing Policy 9-I-9: Work with BART to ensure that its extension of the transit line to SFO through the city results in minimal impact from noise and groundborne vibration.

Implementing Policy 9-I-10: Do not allow new residential or noise-sensitive development in 70 dB+ CNEL areas impacted by SFO operations, as required by Airport Land Use Commission infill criteria. (Amended by City Council Resolution 31-2010)

Implementing Policy 9-I-11: Require new residential development in area between the most recent FAA-accepted 65 and 70 dB CNEL aircraft noise contours for San Francisco International Airport (SFO) to grant an avigation easement to the City and County of San Francisco, as proprietor of SFO. (Amended by City Council Resolution 31-2010)

City of South San Francisco Municipal Code. Title 8 of the City's Municipal Code establishes noise standards in the health and welfare section. Additionally, Title 20 (Zoning) includes performance standards for noise. The applicable sections are as follows:

Section 8.32.030 Maximum Permissible Sound Levels

A. It is unlawful for any person to operate or cause to be operated any source of sound at any location within the city or allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person, which causes the noise level when measured on any other property to exceed:

(1) The noise level standard for that land use as specified in Table 8.32.030 for a cumulative period of more than thirty minutes (30 minutes) in any hour;

(2) The noise level standard plus five dB (+5 dB) for a cumulative period of more than fifteen minutes (15 minutes) in any hour;

(3) The noise level standard plus ten dB (+10 dB) for a cumulative period of more than five minutes (5 minutes) in any hour;

(4) The noise level standard plus fifteen dB (+15 dB) for a cumulative period of more than one minute (1 minute) in any hour; or

(5) The noise level standard or the maximum measured ambient level, plus twenty dB (+20 dB) for any period of time.

B. If the measured ambient level for any area is higher than the standard set in Table 8.32.030, then the ambient shall be the base noise level standard for purposes of subsection A(1) of this section. In such cases, the noise levels for purposes of subsections A(2) through A(5) of this section shall be increased in five dB (5 dB) increments above the ambient.

C. If the measurement location is on a boundary between two different zones, the noise level standard shall be that applicable to the lower noise zone plus five dB (+5 dB).

D. Notwithstanding any other provisions of this chapter, no person shall willfully make or continue, or cause to be made or continued, any loud, unnecessary or unusual noise which disturbs the peace or quiet of any neighborhood.

TABLE 8.32.030 Noise Level Standards[a]

Land Use Category	Time Period	Noise Level (dB)
R-E, R-1, and R-2 zones or any single-family or duplex residential in a specific plan district	10:00 p.m. to 7:00 a.m.	50
	7:00 a.m. to 10:00 p.m.	60
R-3 and D-C zones or any multiple-family residential or mixed residential/commercial in any specific plan district	10:00 p.m. to 7:00 a.m.	55
	7:00 a.m. to 10:00 p.m.	60
C-1, P-C, Gateway and Oyster Point Marina specific plan districts or any commercial use in any specific plan district	10:00 p.m. to 7:00 a.m.	60
M-1, P-1	Anytime	70

[a] Source: Adapted from "The Model Community Noise Control Ordinance," Office of Noise Control, California Department of Health.

Section 8.32.050 Special Provisions

D. Construction. Construction, alteration, repair or landscape maintenance activities which are authorized by a valid city permit shall be allowed on weekdays between the hours of eight a.m. and eight p.m. (8:00 a.m. and 8:00 p.m.), on Saturdays between the hours of nine a.m. and eight p.m. (9:00 a.m. and 8:00 p.m.), and on Sundays and holidays between the hours of ten a.m. and six p.m. (10:00 a.m. and 6:00 p.m.), or at such other hours as may be authorized by the permit, if they meet at least one of the following noise limitations:

(1) No individual piece of equipment shall produce a noise level exceeding ninety dB (90 dB) at twenty-five feet (25 feet). If the device is housed within a structure or trailer on the property, the measurement shall be made outside the structure at a distance as close to twenty-five feet (25 feet) from the equipment as possible.

(2) The noise level at any point outside of the property plane of the project shall not exceed ninety dB (90 dB).

Section 20.300.010 Performance Standards

E. Noise.

(1) Noise Limits. No use or activity shall create ambient noise levels that exceed the standards established in Chapter 8.32 ("Noise Regulation") of the South San Francisco Municipal Code.

(2) Noise Exposure – Land Use Requirements and Limitations. Table 20.300.010 below describes the requirements and limitations of various land uses within the listed CNEL ranges.

TABLE 20.300.010 Noise Exposure – Land Use Requirements and Limitations

Land Use	CNEL Range (dB)	Requirements and Limitations
Residential and other noise-sensitive uses (e.g., schools, hospitals, and churches)	Less than 65	Satisfactory
	65 to 70	Acoustic study and noise attenuation measures required
	Over 70	Not allowed
Commercial	Less than 70	Satisfactory
	70 to 80	Acoustic study and noise attenuation measures required
	Over 80	Airport-related development only; noise attenuation measures required
Industrial	Less than 75	Satisfactory
	75 to 85	Acoustic study and noise attenuation measures required
	Over 85	Airport-related development only; noise attenuation measures required
Open	Less than 75	Satisfactory
	Over 75	Avoid uses involving concentrations of people or animals

(3) Noise Attenuation Measures. Noise attenuation measures identified in an acoustic study shall be incorporated into the project to reduce noise impacts to satisfactory levels.

(4) Maximum Acceptable Interior Noise Levels. New noise-sensitive uses (e.g. schools, hospitals, churches, and residences) shall incorporate noise attenuation measures to achieve and maintain and interior noise level of CNEL 45 dB.

(5) Residential Interior Noise Level Reduction. New dwellings exposed to CNEL above 65 dB shall incorporate the following noise reduction design measures unless alternative designs that achieve and maintain an interior noise level of CNEL 45 dB are incorporated and verified by a Board Certified Acoustical Engineer.

a. All façades must be constructed with substantial weight and insulation;

b. Sound-rated windows providing noise reduction performance similar to that of the faced must be included for habitable rooms;
c. Sound-rated doors or storm doors providing noise reduction performance similar to that of the façade must be included for all exterior entries;

d. Acoustic baffling of vents is required for chimneys, fans, and gable ends;

e. Installation of a mechanical ventilation system affording comfort under closed-window conditions; and

f. Double-stud construction, double doors, and heavy roofs with ceilings of two layers of gypsum board on resilient channels.

Regulatory Background – Vibration

Section 20.300.010 Performance Standards

F. Vibration. No vibration shall be produced that is transmitted through the ground and is discernible without the aid of instruments by a reasonable person at the lot lines of the site. Vibrations from temporary construction, demolition, and vehicles that enter and leave the subject parcel (e.g., construction equipment, trains, trucks, etc.) are exempt from this standard.

While the State of California and the City of South San Francisco do not have quantifiable vibration limits, the U.S. Department of Transportation (DOT) Federal Transit Administration (FTA) has established vibration impact assessment criteria[3] for use in evaluating vibration impacts associated with developments in close proximity to rail lines. The FTA vibration impact criteria are based on maximum overall levels for a single event. The impact criteria for groundborne vibration are shown in Table 5. Note that there are criteria for frequent events (more than 70 events of the same source per day), occasional events (30 to 70 vibration events of the same source per day), and infrequent events (less than 30 vibration events of the same source per day).

[3]Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, September 2018.

TABLE 5 Groundborne Vibration Impact Criteria

Land Use Category	Groundborne Vibration Impact Levels (VdB re 1 µinch/sec, RMS)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1 Buildings where vibration would interfere with interior operations.	65 VdB[4]	65 VdB[4]	65 VdB[4]
Category 2 Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB
Category 3 Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB

Notes:

1. "Frequent Events" is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
2. "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
3. "Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.
4. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research should always require detailed evaluation to define the acceptable vibration levels. Ensuring low vibration levels in a building requires special design of HVAC systems and stiffened floors.

Existing Noise Environment

The project site is located north of Chestnut Avenue, between El Camino Real and Mission Road, in South San Francisco. The site is mostly undeveloped, with two existing BART buildings that would remain under future project conditions. The Kaiser Permanente South San Francisco medical facility is located to the northwest of the project site, opposite Colma Creek, and a parking garage is located to the west of the project site, opposite the creek. Residential land uses and commercial retail land uses are also located to the west, opposite El Camino Real. Additional residential land uses are located adjacent to the site to the north and opposite Mission Road to the northeast and to the east. To the east, opposite Mission Road, are San Mateo County government buildings, and to the south are commercial buildings accessed from Antionette Lane and Chestnut Avenue.

The noise environment at the site and in the surrounding areas results primarily from aircraft associated with San Francisco International Airport and vehicular traffic along El Camino Real and Mission Road. Other noise sources would include mechanical noise associated with the nearby Kaiser medical facility and the existing BART buildings.

A noise monitoring survey was conducted at the site between Friday, November 16, 2018 and Tuesday, November 20, 2018. The survey included two long-term (LT-1 and LT-2) noise

measurements and three short-term (ST-1 through ST-3) noise measurements. All measurement locations are shown in Figure 1.

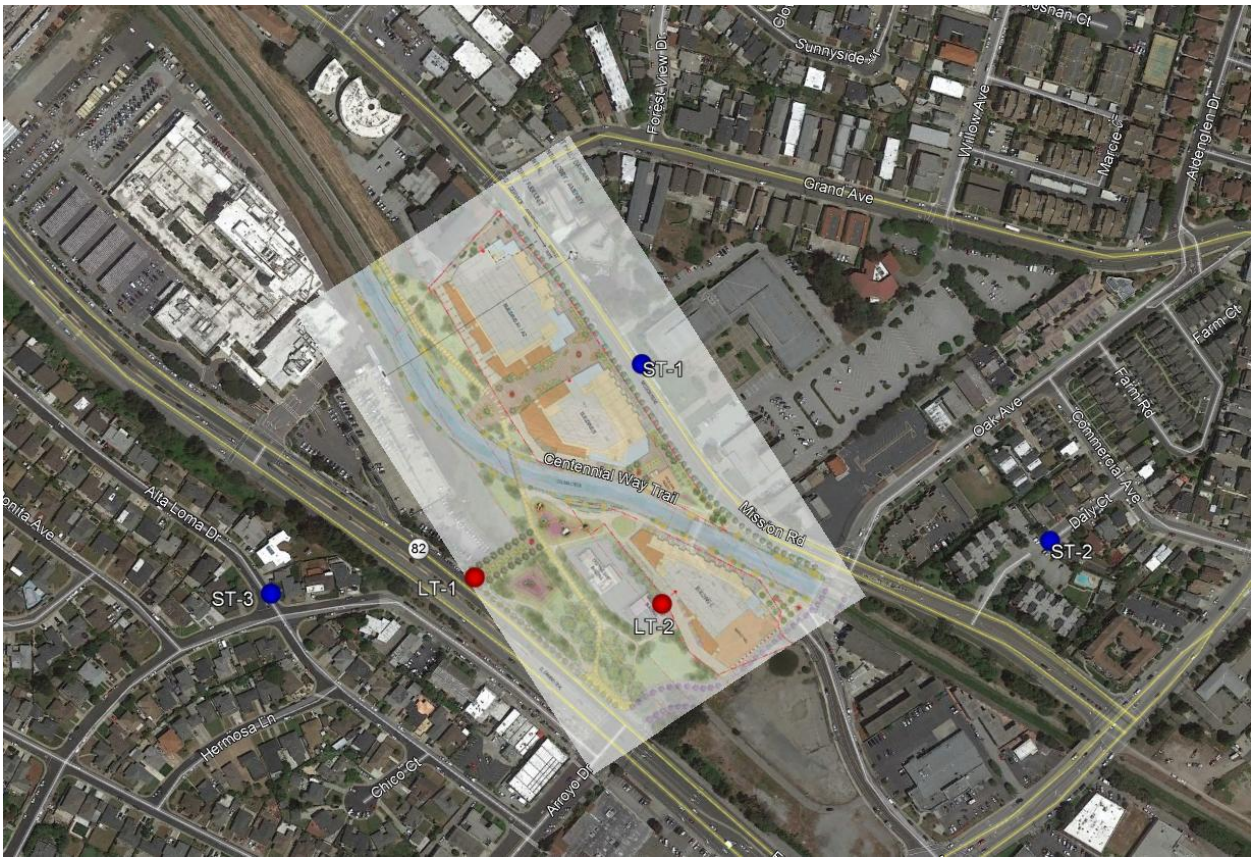
Long-term noise measurement LT-1 was made approximately 65 feet from the centerline of El Camino Real. Hourly average noise levels at LT-1 typically ranged from 68 to 74 dBA L_{eq} during daytime hours between 7:00 a.m. and 10:00 p.m. on weekdays and weekends. During nighttime hours between 10:00 p.m. and 7:00 a.m., hourly average noise levels ranged from 59 to 71 dBA L_{eq} on weekdays and weekends. The average community noise equivalent level during the monitoring period was 74 dBA CNEL on both weekend days and during the one full weekday. The daily trend in noise levels at LT-1 is shown in Figures 2 through 6.

LT-2 was made from a tree east of an existing BART building located on the project site. The main noise source at this location was the mechanical equipment noise associated with the BART building, which would include exhaust systems for the BART tunnel. Hourly average noise levels at LT-2 ranged from 53 to 60 dBA L_{eq} during daytime hours and from 47 to 58 dBA L_{eq} during nighttime hours. The average community noise equivalent level during the monitoring period was 61 dBA CNEL on Monday, November 19, 2018, and ranged from 61 to 62 dBA CNEL on the weekend days. The daily trend in noise levels at LT-2 is shown in Figures 7 through 11.

Short-term noise measurements were made on Friday, November 16, 2018 between 2:10 p.m., and 3:20 p.m. Each of the short-term measurements were made in 10-minute intervals, and the results of the measurements are summarized in Table 6.

Short-term noise measurement ST-1 was made in front of the San Mateo County Northern District Court Building, approximately 25 feet from the centerline of Mission Road. The dominant noise source at ST-1 was roadway traffic, with passenger vehicles generating noise levels of 65 to 75 dBA during this 10-minute measurement. Additionally, three aircraft flyovers occurred during this measurement, generating noise levels of 54 to 69 dBA. The 10-minute L_{eq} measured at ST-1 was 65 dBA $L_{eq(10\text{-}min)}$. ST-2 was made at the end of Daly Court, approximately 15 feet from the 6-foot sound wall located at the end of the roadway. The predominant noise source was nearby Mission Road traffic. During the 10-minute period, four aircraft flyovers also occurred, generating noise levels ranging from 53 to 59 dBA. The 10-minute L_{eq} measured at ST-2 was 49 dBA $L_{eq(10\text{-}min)}$. ST-3 was made near the corner of Alta Loma Drive and Del Paso Drive, west of SR 82. A total of 16 passenger vehicles passed by ST-3 during the 10-minute period, generating noise levels of 65 to 70 dBA. Seven aircraft flyovers also occurred during this measurement period, generating noise levels of 55 to 72 dBA. The 10-minute L_{eq} measured at ST-3 was 61 dBA $L_{eq(10\text{-}min)}$.

FIGURE 1 Noise Measurement Locations



Source: Google Earth 2018.

FIGURE 2 Daily Trend in Noise Levels at LT-1, Friday, November 16, 2018

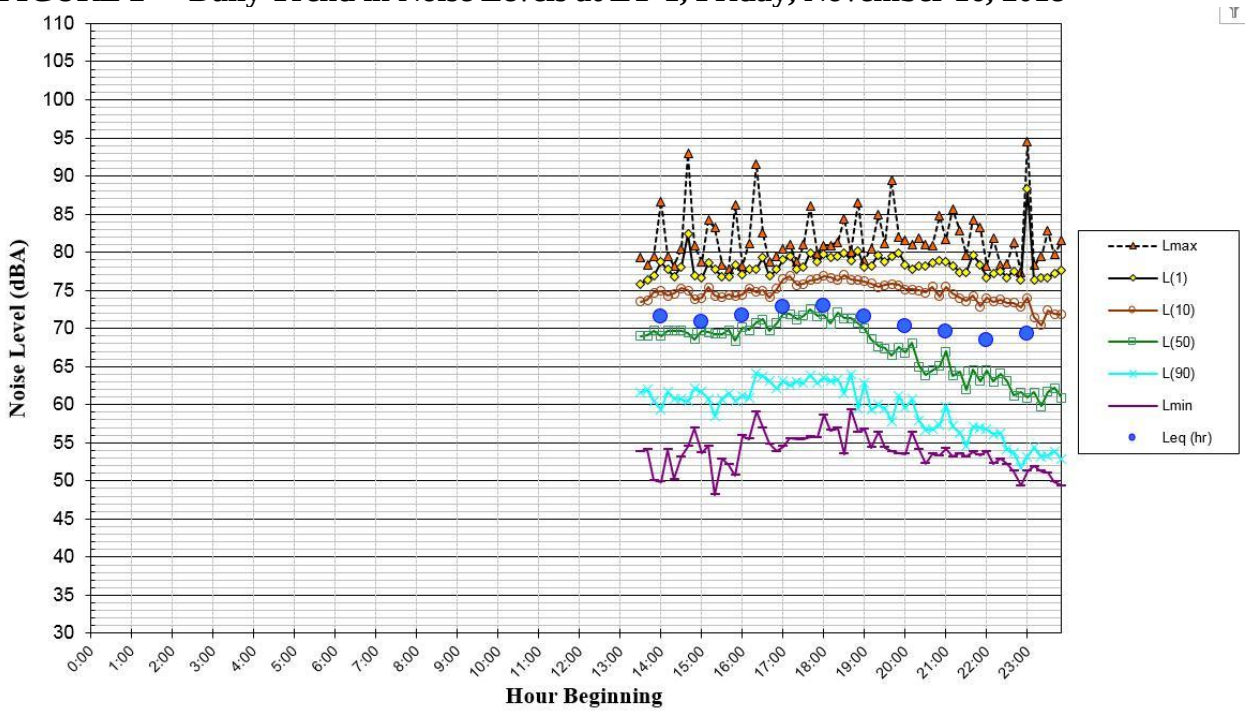


FIGURE 3 Daily Trend in Noise Levels at LT-1, Saturday, November 17, 2018

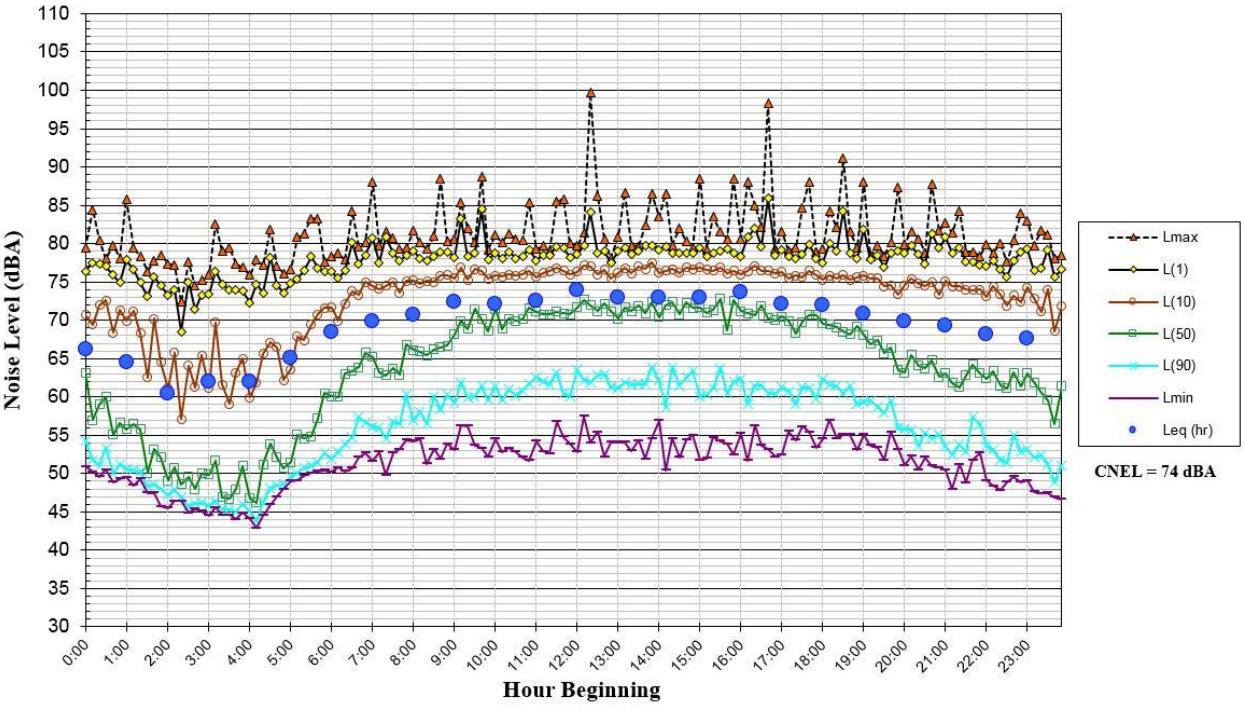


FIGURE 4 Daily Trend in Noise Levels at LT-1, Sunday, November 18, 2018

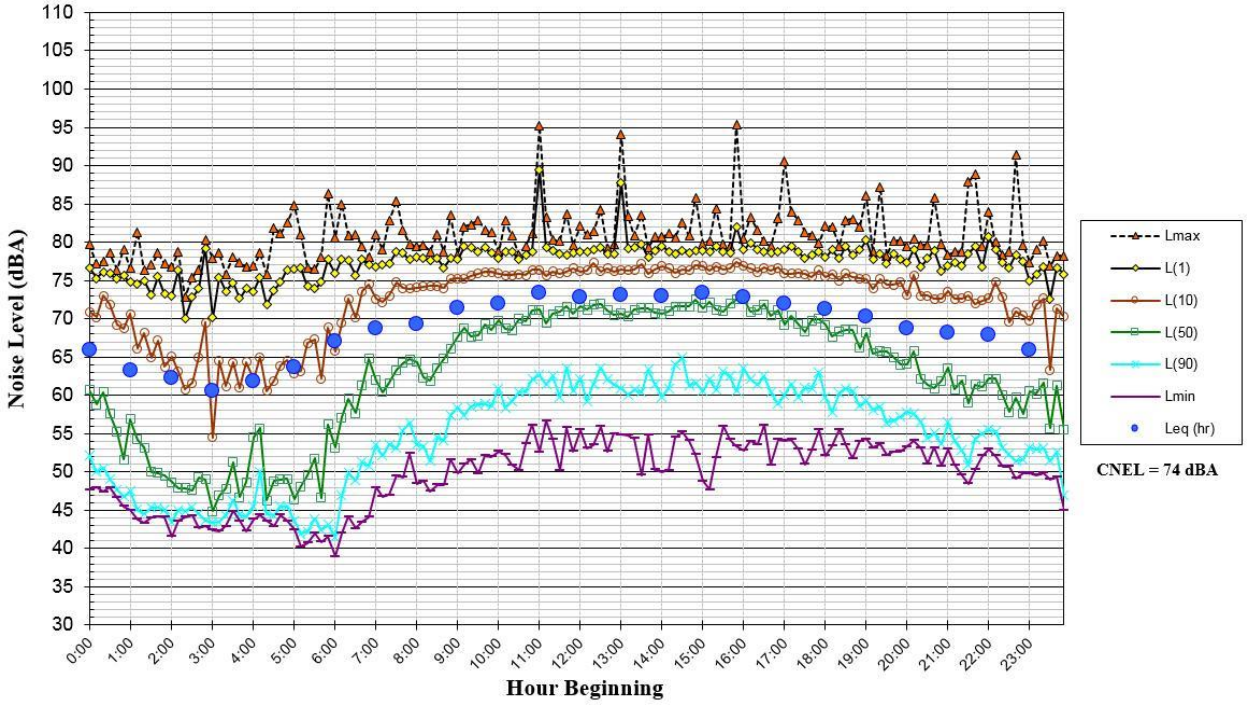


FIGURE 5 Daily Trend in Noise Levels at LT-1, Monday, November 19, 2018

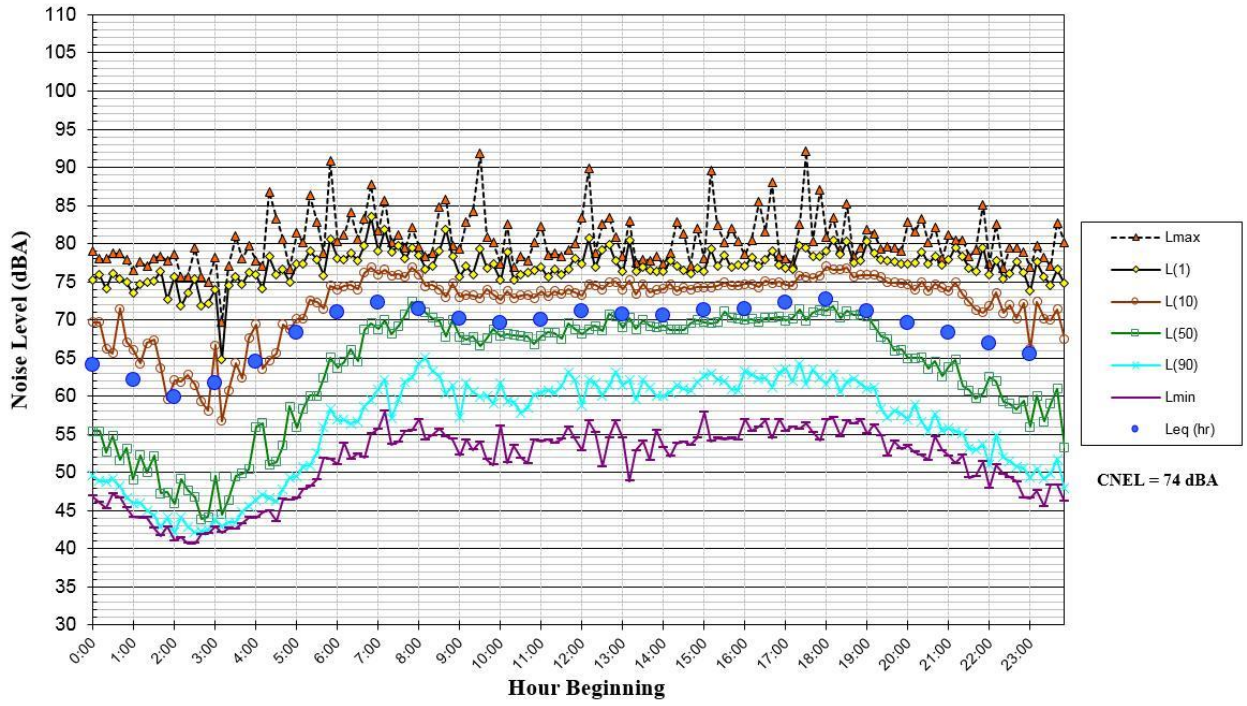


FIGURE 6 Daily Trend in Noise Levels at LT-1, Tuesday, November 20, 2018

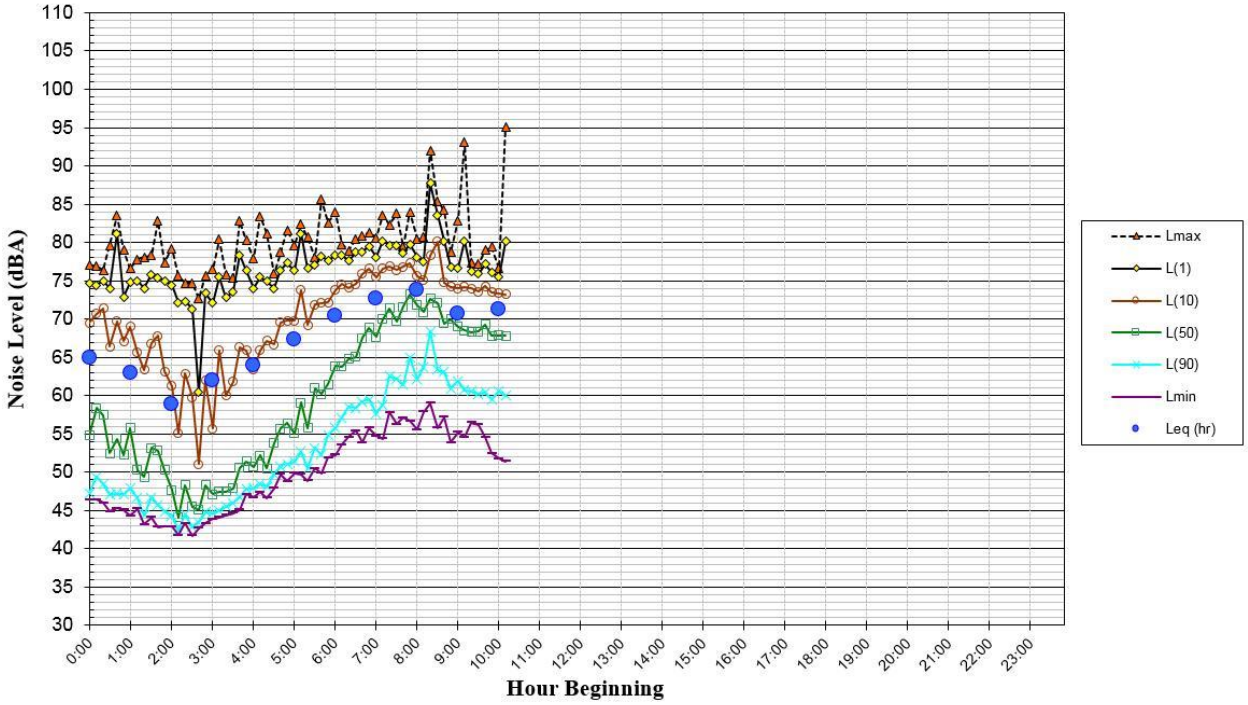


FIGURE 7 Daily Trend in Noise Levels at LT-2, Friday, November 16, 2018

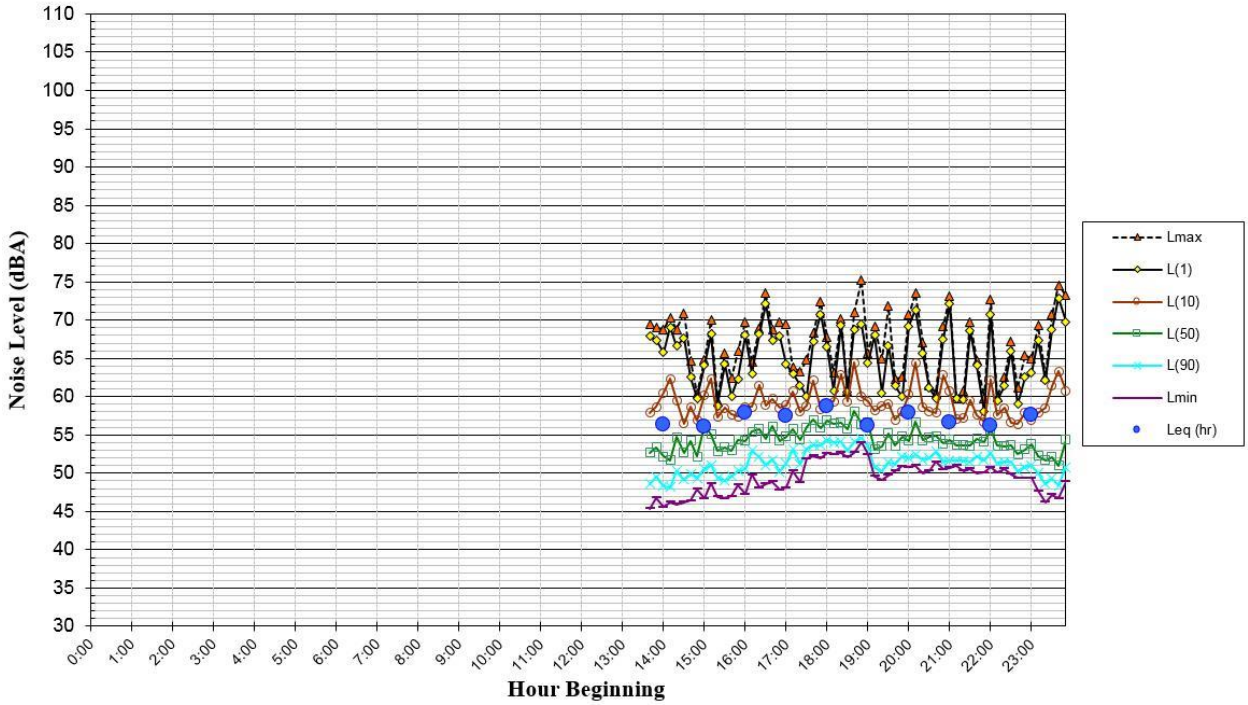


FIGURE 8 Daily Trend in Noise Levels at LT-2, Saturday, November 17, 2018

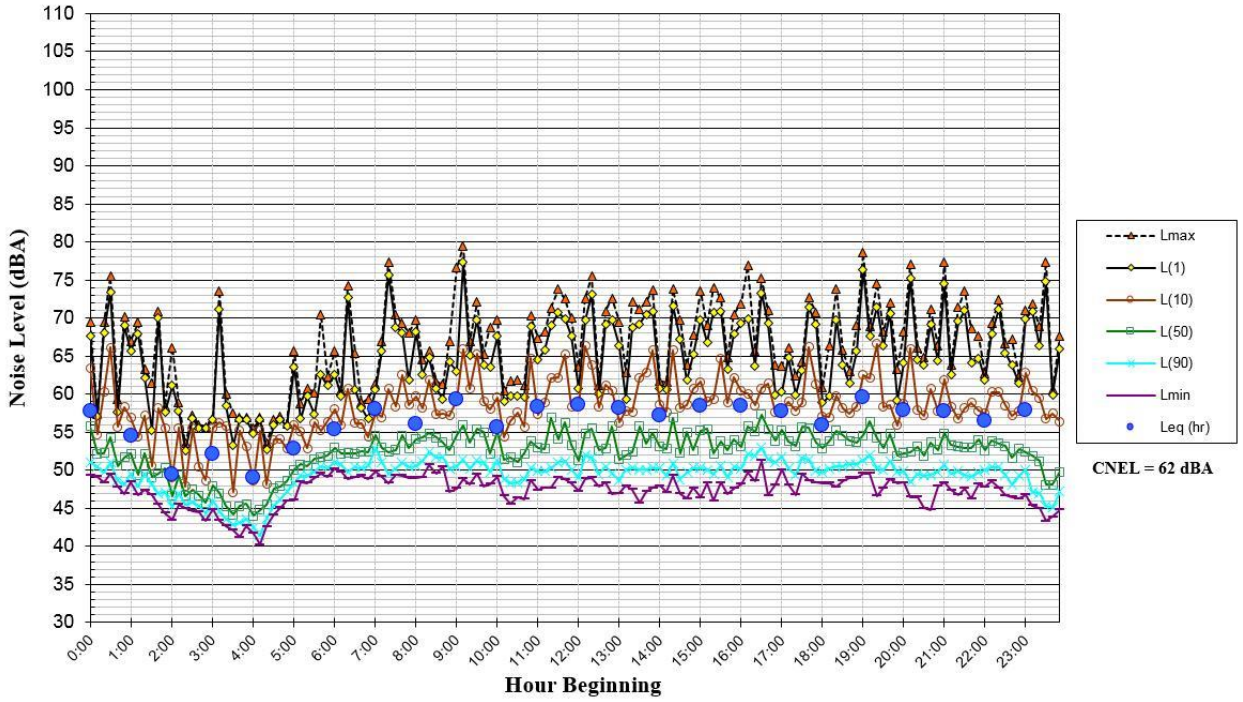


FIGURE 9 Daily Trend in Noise Levels at LT-2, Sunday, November 18, 2018

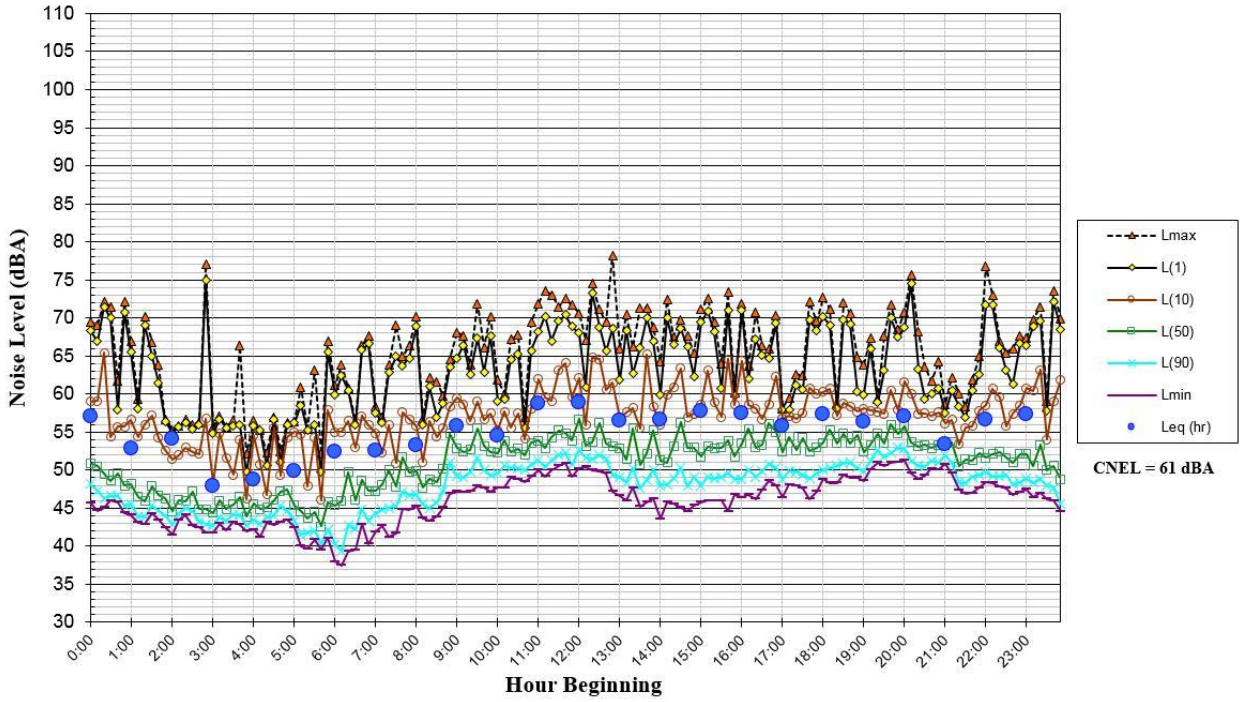


FIGURE 10 Daily Trend in Noise Levels at LT-2, Monday, November 19, 2018

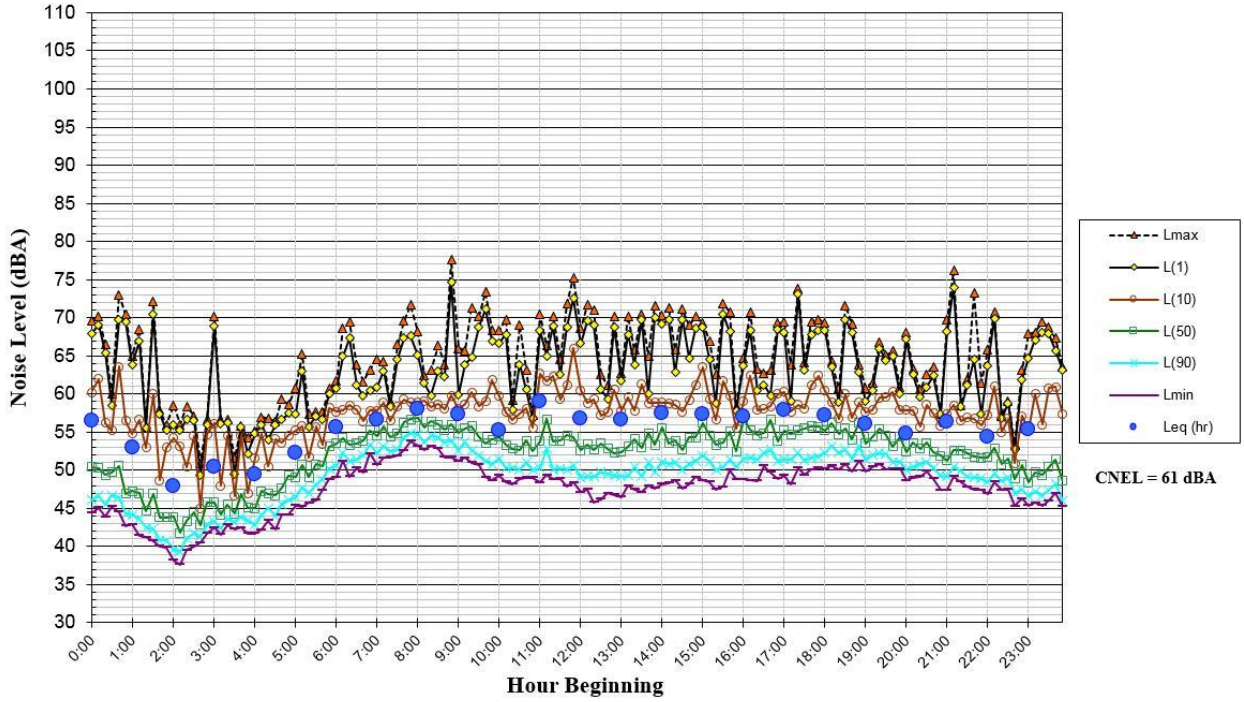


FIGURE 11 Daily Trend in Noise Levels at LT-2, Tuesday, November 20, 2018

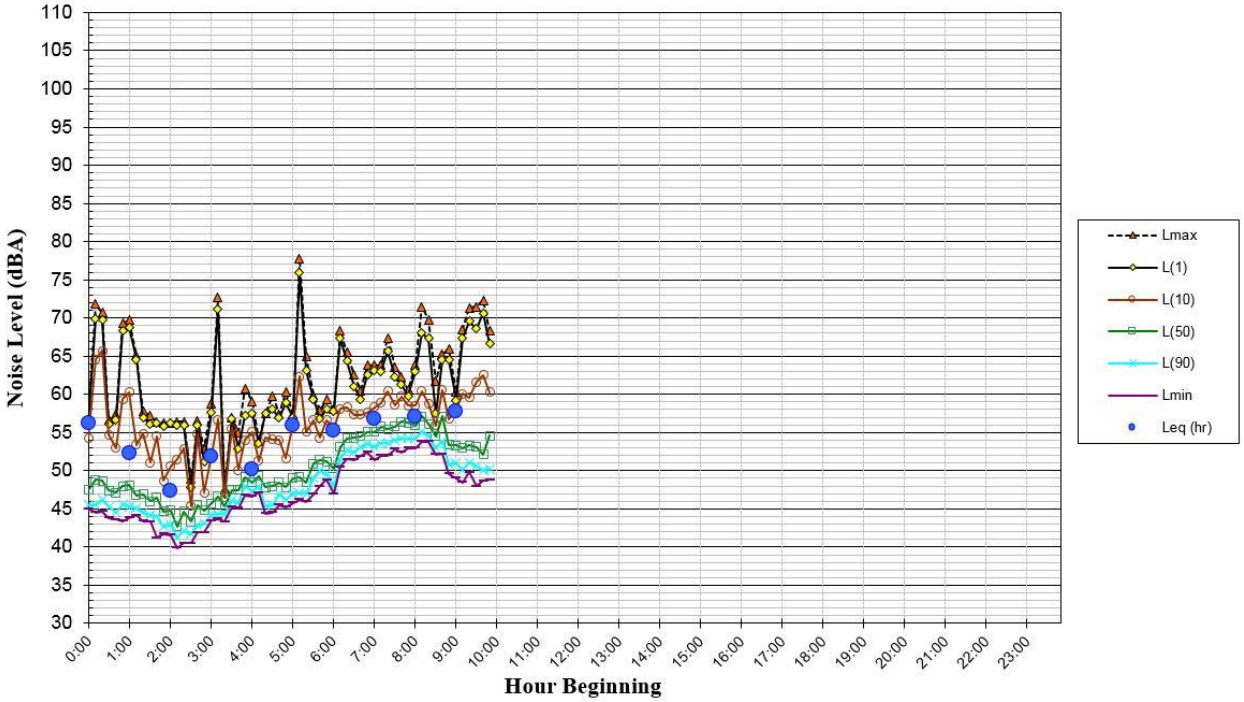


TABLE 6 Summary of Short-Term Noise Measurements (dBA)

Noise Measurement Location (Date, Time)	Measured Noise Level, dBA					
	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	$L_{eq(10\text{-}min)}$
ST-1: Front of San Mateo County Northern District Court Building (11/16/2018, 14:10-14:20)	77	74	69	61	51	65
ST-2: End of Daly Court (11/16/2018, 14:40-14:50)	59	50	52	46	42	49
ST-3: Corner of Alta Loma Drive and Del Paso Drive (11/16/2018, 15:10-15:20)	73	72	65	62	45	61

PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility Assessment

The City's Municipal Code states that noise levels at noise-sensitive outdoor use areas, which would include residences, should be maintained below 65 dBA CNEL to be considered satisfactory. This exterior noise standard would apply to common outdoor use areas, but the exterior noise standard would not be applied at small private decks or balconies proposed by the project. For commercial uses, noise levels should be maintained below 70 dBA CNEL to be considered satisfactory. Exterior noise levels below 75 dBA CNEL at open spaces, such as parks and playgrounds, would be considered satisfactory by the City of South San Francisco. A noise standard of 45 dBA CNEL would apply to residential and school interiors proposed by the project.

The future noise environment at the project site would continue to result primarily from aircraft associated with San Francisco International Airport and traffic along El Camino Real and Mission Road. While aircraft noise is not expected to substantially change in the future, vehicular traffic along the surrounding roadways would increase under future conditions. A traffic study was completed for the El Camino Real/Chestnut Area Plan,[4] which would include the proposed project. According to this study, traffic volumes along El Camino Real and Mission Road would increase by 3 dBA CNEL under cumulative plus project conditions, while the traffic noise increase would be 2 dBA CNEL along Chestnut Avenue. Therefore, the future noise level would be 77 dBA CNEL at a distance of 65 feet from the centerline of El Camino Real and would range from 64 to 65 dBA CNEL at a distance of 300 feet from the centerline of Mission Road.

Noise produced by the existing Kaiser medical facility and adjacent parking structure, which is located to the northwest of the project site, opposite the creek, would also affect the noise environment at the project site. The future residents on the project site would be exposed to noise generated by mechanical equipment, such as chilling units and emergency generators. The noise levels measured at the project site would include typical noise levels from the Kaiser medical facility and parking structure. According to the City's Municipal Code, if ambient noise levels exceed thresholds stated in Table 8.43.030, then ambient noise levels would be standard. Since noise levels from the Kaiser medical facility and parking structure are included in the ambient noise measurements made at the site and no changes at these facilities are expected under future

[4] Kimley-Horn and Associates, Inc., "El Camino Real/Chestnut Area Plan, Draft Traffic Impact Analysis," February 2011.

conditions, there is no additional noise level increase expected due to medical or parking lot activities.

Future Exterior Noise Environment

The proposed project includes two park areas, two playgrounds, and up to five commercial plazas on the ground level. Additionally, Buildings A, B, and C would each include podium-level courtyards and roof decks associated with the residential component of the proposed project.

Residential Land Uses

According to the site plan, the podium-level courtyards would be located on the fourth level of each building, and these courtyards would be shielded from traffic noise along Mission Road. Additionally, the proposed building façades would also provide shielding from the Kaiser medical facility. However, these courtyards would have some exposure to traffic noise along El Camino Real, as well as exposure to overhead aircraft. The edge of each of the courtyards would be 340 feet or more from the centerline of El Camino Real, with the centers of each courtyard being an additional 30 feet or more away. Assuming partial shielding due to the proposed and existing buildings, the future noise environment at each of the courtyards where most of the activity would occur (i.e., near the center of the courtyards) would be below 65 dBA CNEL.

The proposed roof decks would be located above the eighth floors on the southern building façades of each proposed building. While the centers of each of these roof decks would be 425 feet or more from the centerline of El Camino Real, the distances from the centers of the roof decks to the centerlines of Mission Road would range from 185 to 225 feet. The locations of the roof decks with respect to edge of the building façades facing the roadways and the heights of the roof decks (more than 80 feet) result in partial shielding for each roof deck. Furthermore, the roof decks proposed at Buildings A and B have greater setbacks than the roof deck at Building C, resulting in more shielding effects for these outdoor use areas. The future noise environment at these roof decks would be below 65 dBA CNEL when considering the shielding from the intervening buildings. However, the roof deck at Building C would be along the façade adjacent to Mission Road and would have some direct line-of-sight to the roadway. While the center of the roof deck would be set back far enough to result in future noise levels below 65 dBA CNEL, future noise levels at the edge of the roof deck would reach 65 dBA CNEL.

The residential courtyards proposed for this project would be compatible with the future noise environment at the site, and no additional measures would be required to meet the City's standards. The roof decks proposed at Buildings A and B would meet the City's thresholds. Additionally, the center of the roof deck located at Building C would also meet the City's threshold of below 65 dBA CNEL. The proposed outdoor use areas associated with the residential component of the proposed project would be compatible with the City's noise limitations. No further measures would be required.

Commercial Spaces

Three maker's plazas and one market plaza are proposed as part of the project. Each of the maker's plazas would be located to the west of Building's A, B, and C and would be shielded from traffic noise along Mission Road. The existing BART buildings, Kaiser medical facility, and parking

structure would also provide partial shielding from El Camino Real traffic. The future exterior noise levels at each of the maker's plazas would be below 70 dBA CNEL.

The market plaza would be located at the southeast corner of Building C, adjacent to Mission Road. The center of the market plaza would be set back approximately 150 feet from the centerline of Mission Road, and at this distance, the future exterior noise levels would be 70 dBA CNEL. According to Table 20.300.010 of the City's Municipal Code, noise levels ranging from 70 to 80 dBA CNEL would require noise attenuation measures.

The noise threshold is only exceeded by 1 dBA CNEL at the center of the market plaza, and the outdoor use area would not be considered noise-sensitive. Therefore, the City could provide a noise exemption for this commercial outdoor use area, allowing the 70 dBA CNEL future noise level without additional noise attenuation measures. Assuming the City would require the additional measures to achieve a noise environment less than 70 dBA CNEL, recommendations are discussed below.

Playgrounds

According to the site plan, two inclusive playgrounds are proposed as part of the project. Both playgrounds are proposed to be located west of Colma Creek. While the centers of both playgrounds would be set back from the centerline of Mission Road by more than 380 feet with partial shielding from this roadway provided by the project buildings, both playgrounds would have direct line-of-sight to El Camino Real. The center of the playground adjacent to El Camino Real would be set back approximately 135 feet from the centerline of the roadway. Additionally, the elevation of the playground is approximately 8 feet below the roadway. The future exterior noise levels at the nearest playground to El Camino Real would be 69 dBA CNEL.

The center of the second playground would be set back 275 feet from the centerline of El Camino Real and would be at an elevation of more than 15 feet below the roadway. The future exterior noise levels at this outdoor use area would be below 65 dBA CNEL.

The child care facility proposed as part of the project would be located to the south of Building B, adjacent to Mission Road. Due to the location of both playgrounds, these outdoor use areas would not be considered part of the child care facility. Therefore, these outdoor use areas would fall within the open space category of Table 20.300.010 of the City's Municipal Code. With the satisfactory noise limit being below 75 dBA CNEL, both the playgrounds would meet the City's thresholds, and no further measures would be required.

Parks

Two parks, which would include exercise equipment, are proposed as part of the project. One park area would be located adjacent to El Camino Real, near the first playground discussed above. With the center of the park having approximately the same setback as the playground, the future exterior noise levels would be 69 dBA CNEL. This would meet the City's 75 dBA CNEL threshold.

The second park would be located northwest Building A, adjacent to Colma Creek. Due to proposed and existing buildings, this park area would be mostly shielded from Mission Road and

El Camino Real. The future exterior noise levels would be below 65 dBA CNEL, which would meet the City's 75 dBA CNEL threshold. No further measures would be required.

Recommended Measures to Reduce Exterior Noise Levels

Methods available to reduce exterior noise levels at the market plaza would include site planning alternatives (e.g., increased setbacks and using the proposed buildings as noise barriers), the construction of traditional noise barriers, or a combination of the above. Assuming relocating the plaza would not be feasible, the optimal measure for noise reduction would be to construct a sound wall or a specially-designed barrier fence capable of reducing noise levels by at least 1 dBA.

For a barrier to be effective, the line-of-sight between the occupants of the outdoor space and the noise source must be broken. Therefore, a perimeter barrier along the northern, southern, and eastern boundaries with a minimum height of 5 feet would be required. To maximize effectiveness of the barrier, the barrier should attach to Building C at both ends. Due to the nature of this outdoor use area, a traditional barrier would reduce visibility and aesthetic appeal. A specially-designed barrier made of ½-inch laminated glass would be an option so the market plaza occupants could see through the barrier. The proposed barrier should be continuous from grade to top, with no cracks or gaps, and have a minimum surface density of three lbs/ft.^{2} Other options for the barrier construction would include one-inch thick marine-grade plywood or concrete masonry units (CMU).

Assuming the barrier is determined to be the best option, final recommendations shall be confirmed when detailed site plans and grading plans are available. With the implementation of this proposed barrier, the exterior noise environment would be below 70 dBA CNEL.

Future Interior Noise Environment

<u>Residential Land Uses and the Child Care Facility</u>
Standard residential construction provides approximately 15 dBA of exterior-to-interior noise reduction, assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. Where exterior noise levels range from 60 to 65 dBA CNEL, the inclusion of adequate forced-air mechanical ventilation is often the method selected to reduce interior noise levels to acceptable levels by closing the windows to control noise. Where noise levels exceed 65 dBA CNEL, forced-air mechanical ventilation systems and sound-rated construction methods are normally required. Such methods or materials may include a combination of smaller window and door sizes as a percentage of the total building façade facing the noise source, sound-rated windows and doors, sound-rated exterior wall assemblies, and mechanical ventilation so windows may be kept closed at the occupant's discretion.

The eastern façades of proposed Buildings A, B, and C, as well as the proposed child care facility, would have setbacks from the centerline of Mission Road ranging from 70 to 200 feet. The residential units and classrooms would be exposed to future exterior noise levels ranging from 70 to 75 dBA CNEL. The western façades of Buildings A, B, and C are setback from the centerline

of El Camino Real by 300 to 595 feet. At these distances, the units along these façades would be exposed to future exterior noise levels ranging from 61 to 67 dBA CNEL.

With windows partially open for ventilation, interior noise level would be up to 60 dBA CNEL at the exterior-facing units along the eastern building façade, nearest Mission Road and up to 52 dBA CNEL at the units facing El Camino Real. Sound-rated windows and doors would be required to meet the City's 45 dBA CNEL interior threshold.

Commercial Spaces

Hourly average noise levels during business hours would be required to meet the 50 dBA $L_{eq(1\text{-}hr)}$ threshold established by the 2016 Cal Green Code within proposed commercial land uses. Standard construction materials for commercial uses would typically range from 20 to 25 dBA of noise reduction in interior spaces. The inclusion of adequate forced-air mechanical ventilation systems is normally required so windows may be kept closed at the occupants' discretion.

The market hall, which is located along the southern façade of Building C would stretch along the entire width of the building. The setback from the centerline of Mission Road would be approximately 180 feet, and the setback from the centerline of El Camino Real would be approximately 300 feet. At these distances, hourly average exterior noise levels during hours of operation would range from 67 to 70 $L_{eq(1\text{-}hr)}$. Assuming a minimum of 20 dBA of exterior-to-interior noise reduction, the future interior noise levels would range from 47 to 50 dBA $L_{eq(1\text{-}hr)}$ at the Market Hall.

The site plan also shows some live-work/flex units, which may be used for commercial use. Each of these units would have greater setbacks from Mission Road, with at least partial shielding from proposed project buildings, and the setbacks from the centerline of El Camino Real would be 295 feet or more, with partial shielding from existing buildings. Each of these units would be exposed to future exterior noise levels of 70 dBA $L_{eq(1\text{-}hr)}$ or less. Therefore, these units would have interior noise levels at or below 50 dBA $L_{eq(1\text{-}hr)}$.

With standard construction materials, the proposed building interior would meet the daytime operational noise levels established in the Cal Green standard and would not require noise insulation features to be compatible with the noise environment at the site.

Noise Insulation Features to Reduce Future Interior Noise Levels

Detailed unit layouts were not available at the time of this study; however, preliminary calculations were made to estimate Sound Transmission Class (STC)[5] ratings for doors and windows. The following noise insulation features shall be incorporated into the proposed project to reduce interior noise levels to 45 dBA CNEL or less:

[5] **Sound Transmission Class -** A single figure rating designed to give an estimate of the sound insulation properties of a partition. Numerically, STC represents the number of decibels of speech sound reduction from one side of the partition to the other. The STC is intended for use when speech and office noise constitute the principal noise problem.

- Provide a suitable form of forced-air mechanical ventilation, as determined by the local building official, for all units on the project site, so that windows can be kept closed at the occupant's discretion to control interior noise and achieve the interior noise standards.

- Preliminary calculations indicate that the residential units along the eastern building façades of Buildings A, B, and C, adjacent to Mission Road, as well as the child care facility, would require windows and doors with a minimum STC rating of 31 and an adequate form of forced-air mechanical ventilation to meet the interior noise threshold of 45 dBA CNEL.

- The exterior-facing units along the western building façades of Buildings A, B, and C would require windows and doors with a minimum STC rating of 28 and an adequate form of forced-air mechanical ventilation to meet the 45 dBA CNEL threshold.

- A qualified acoustical specialist shall prepare a detailed analysis of interior residential noise levels resulting from all exterior sources during the design phase pursuant to requirements set forth in the State Building Code. The study will review the final site plan, building elevations, and floor plans prior to construction and recommend building treatments to reduce residential interior noise levels to 45 dBA CNEL or lower. Treatments would include, but are not limited to, sound-rated windows and doors, sound-rated wall and window constructions, acoustical caulking, protected ventilation openings, etc. The specific determination of what noise insulation treatments are necessary shall be conducted on a unit-by-unit basis during final design of the project. Results of the analysis, including the description of the necessary noise control treatments, shall be submitted to the City, along with the building plans and approved design, prior to issuance of a building permit.

The implementation of these noise insulation features would reduce interior noise levels to 45 dBA CNEL or less.

Vibration and Land Use Compatibility

Due to the nearby BART tracks being underground, measuring statistical train pass-bys was not practical. However, the proposed project includes an underground parking structure, which would be approximately 100 feet from the underground BART tracks. Additionally, each of the proposed buildings would be 100 feet or more from the tracks. The Transit Noise and Vibration Impact Assessment completed by the FTA[1] indicates that underground subways vary in vibration response more than at-grade trains. Figure 10-1 shows a typical curve for rapid transit rail vehicles at 50 mph. Taking into account both lateral distance and depth, the diagonal distance is used to estimate the vibration levels at 50 mph. According to a 1999 online article written about the BART tunneling to SFO,[6] the underground BART tunnel was to be two to three stories deep, which would be a maximum of 25 to 40 feet below the surface. However, from the underground garage, the distance would be closer to 100 feet in the lateral direction. From Figure 10-1, vibration levels at the nearest building façades of the proposed buildings would range from 65 to 68 VdB when trains are traveling at 50 mph. The FTA manual also provides an adjustment calculation for varying

[6] https://www.sfgate.com/bayarea/article/TUNNELING-TO-SFO-BART-airport-project-goes-from-2925364.php

speeds. BART trains could travel up to 80 mph, which would result in vibration levels ranging from 69 to 72 VdB at the nearest building façades.

The applicable threshold for frequent events would be 72 VdB. While BART trains traveling at 80 mph past the project site are not expected due to the close proximity of the nearest station, BART train pass-bys could produce vibration levels that would equal the criterion established in the FTA manual. The FTA manual also mentions that underground vibration from subways tends to higher frequency than the vibration from at-grade trains. Therefore, a more in-depth frequency analysis of the spectra for individual pass-by events may be required by the City.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

The following criteria were used to evaluate the significance of environmental noise resulting from the project:

- A significant noise impact would be identified if the project would generate a substantial temporary or permanent noise level increase over ambient noise levels at existing noise-sensitive receptors surrounding the project site and that would exceed applicable noise standards presented in the General Plan or Municipal Code at existing noise-sensitive receptors surrounding the project site.

    - Hourly average noise levels during construction that would exceed 60 dBA L_{eq} at residential land uses or exceed 70 dBA L_{eq} at commercial land uses and exceed the ambient noise environment by at least 5 dBA L_{eq} for a period of more than one year would constitute a significant temporary noise increase in the project vicinity.

    - A significant permanent noise level increase would occur if project-generated traffic would result in: a) a noise level increase of 5 dBA CNEL or greater, with a future noise level of less than 60 dBA CNEL, or b) a noise level increase of 3 dBA CNEL or greater, with a future noise level of 60 dBA CNEL or greater.

    - A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan or Municipal Code.

- A significant impact would be identified if the construction of the project would generate excessive vibration levels surrounding receptors. Groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.

- A significant noise impact would be identified if the project would expose people residing or working in the project area to excessive noise levels.

Impact 1a: **Temporary Construction Noise.** Existing noise-sensitive land uses would be exposed to a temporary increase in ambient noise levels due to project construction

activities. The incorporation of construction best management practices as project conditions of approval would result in a **less-than-significant** temporary noise impact.

Noise impacts resulting from construction depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time.

Section 8.32.050 of the City's Municipal Code defines the allowable construction hours between 8:00 a.m. and 8:00 p.m. on weekdays, between 9:00 a.m. and 8:00 p.m. on Saturdays, and between 10:00 a.m. and 6:00 p.m. on Sundays and holidays. Section 8.32.050 also provides construction noise limits of 90 dBA at a distance of 25 feet for any single piece of equipment. Additionally, the noise level at any point outside of the property plane of the project site is limited to 90 dBA.

The noise level threshold for speech interference indoors is 45 dBA. Assuming a 15 dBA exterior-to-interior reduction for standard residential construction and a 25 dBA exterior-to-interior reduction for standard commercial construction, this would correlate to an exterior threshold of 60 dBA L_{eq} at residential land uses and 70 dBA L_{eq} at commercial land uses. Additionally, temporary construction would be annoying to surrounding land uses if the ambient noise environment increased by at least 5 dBA L_{eq} for an extended period of time. Therefore, the temporary construction noise impact would be considered significant if project construction activities exceeded 60 dBA L_{eq} at nearby residences or exceeded 70 dBA L_{eq} at nearby commercial land uses and exceeded the ambient noise environment by 5 dBA L_{eq} or more for a period longer than one year.

The nearest existing residential receptors are located adjacent to the northern boundary of the project site. Additionally, there are residences located to the east, opposite Mission Road, near the proposed Building A. Each of these receptors would be represented by noise measurements made at ST-1, which recorded a daytime noise level of 65 dBA L_{eq}. The courthouse, other commercial buildings along Mission Road, and the residences located east of the proposed Building C would also be represented by ST-1. The Kaiser medical facility, which is located west of the project site, opposite Colma Creek, would be represented by ambient measurements made at LT-1. During daytime hours, noise levels ranged from 68 to 74 dBA L_{eq} at LT-1. For the residential buildings located to the south of the site, which are set back from both Mission Road and El Camino Real, ambient measurements made at LT-2 would represent the daytime noise environment. At LT-2, daytime noise levels ranged from 53 to 60 dBA L_{eq}. Additionally, there are single-family residences and commercial land uses located opposite El Camino Real from the project site. The ambient noise environment at these receptors would be represented by ST-3, which recorded a daytime noise level of 61 dBA L_{eq}.

Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The highest maximum noise levels generated by project construction would typically range from about 80 to 90 dBA L_{max} at a distance of 50 feet from the

noise source. A list of typical maximum instantaneous noise levels measured at 50 feet are provided in Table 7. Typical hourly average construction-generated noise levels for residential mixed-use buildings are about 81 to 88 dBA L_{eq} measured at a distance of 50 feet from the center of the site during busy construction periods (e.g., earth moving equipment, impact tools, etc.), as shown in Table 8. Hourly average noise levels for roadway extensions and bridge work that would not require pile driving would range from 79 to 88 dBA L_{eq} at a distance of 50 feet from the center of the active construction site. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain can provide an additional 5 to 10 dBA noise reduction at distant receptors.

Three construction phases are expected for the mixed-use building of the proposed project: 1) Phase I would include the construction of Building C; 2) Phase II would include the underground parking structure connecting Buildings A and B; and 3) Phase III would include the construction of Buildings A and B. The construction of the Oak Avenue extension bridge is not expected to occur at the same time as the buildings; however, this construction work could happen soon after the proposed buildings are constructed. This would extend the total construction duration by as much as six months. A detailed list of equipment expected to be used for the proposed project construction during each phase of construction was not available at the time of this study. Without detailed equipment lists and phasing information, typical noise levels provided in Tables 7 and 8 were used to estimate the worst-case scenario of noise levels at the nearby existing land uses. For the construction of the proposed Oak Avenue extension bridge, microtunneling would be required, but pile driving is not expected.

Using the noise levels in Table 7, the proposed project could potentially exceed the 90 dBA threshold for a single piece of equipment at a distance of 25 feet or could potentially exceed the 90 dBA L_{eq} threshold outside the property plane of the project site. The typical noise levels by phase summarized in Table 8 were used to estimate typical hourly average noise levels at the property lines of surrounding land uses during the construction of Buildings C, B, and A, as well as the Oak Avenue extension bridge. The results are summarized in Tables 9, 10, and 11 for the buildings, respectively, and the results for the extension bridge are summarized in Table 12. The construction noise levels for each of the buildings were estimated using distances measured from the center of each building to the property line of the surrounding land uses. These levels do not assume reductions due to intervening buildings. Rather than estimate the excavation of the underground parking garage from the center point, which would be between Buildings A and B, splitting up the construction would reduce the total distance to the nearby land uses and be more conservative from a noise standpoint. The noise levels summarized in Table 12 were estimated from the center of the proposed bridge to the nearest property lines of the existing and future receptors in the immediate vicinity of the proposed bridge.

The results in Tables 9 through 12 show that hourly average noise levels during construction would temporarily exceed 60 dBA L_{eq} at residential land uses and 70 dBA L_{eq} at commercial land uses and would exceed ambient noise levels by 5 dBA L_{eq} or more. Considering the size and complexity of the proposed project, it is expected that total project construction would occur for a period longer than one year.

Reasonable regulation of the hours of construction, as well as regulation of the arrival and operation of heavy equipment and the delivery of construction material, are necessary to protect the health and safety of persons, promote the general welfare of the community, and maintain the quality of life.

Construction activities will be conducted in accordance with the provisions of the City's Municipal Code, which limits temporary construction work to between 8:00 a.m. and 8:00 p.m. on weekdays, to between 9:00 a.m. and 8:00 p.m. on Saturdays, and to between 10:00 a.m. and 6:00 p.m. on Sundays and holidays. Additionally, the construction crew shall adhere to the following construction best management practices to reduce construction noise levels emanating from the site and minimize disruption and annoyance at existing noise-sensitive receptors in the project vicinity. With the incorporation of the following construction best management practices into the project design as conditions of approval, this would be a less-than-significant impact.

Construction Best Management Practices

Develop a construction noise control plan, including, but not limited to, the following available controls:

- Construct temporary noise barriers, where feasible, to screen stationary noise-generating equipment. Temporary noise barrier fences would provide a 5 dBA noise reduction if the noise barrier interrupts the line-of-sight between the noise source and receptor and if the barrier is constructed in a manner that eliminates any cracks or gaps.

- Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.

- Unnecessary idling of internal combustion engines should be strictly prohibited.

- Locate stationary noise-generating equipment, such as air compressors or portable power generators, as far as possible from sensitive receptors as feasible. If they must be located near receptors, adequate muffling (with enclosures where feasible and appropriate) shall be used to reduce noise levels at the adjacent sensitive receptors. Any enclosure openings or venting shall face away from sensitive receptors.

- Utilize "quiet" air compressors and other stationary noise sources where technology exists.

- Construction staging areas shall be established at locations that will create the greatest distance between the construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction.

- Locate material stockpiles, as well as maintenance/equipment staging and parking areas, as far as feasible from residential receptors.

- Control noise from construction workers' radios to a point where they are not audible at existing residences bordering the project site.

- The contractor shall prepare a detailed construction schedule for major noise-generating construction activities. The construction plan shall identify a procedure for coordination with adjacent residential land uses so that construction activities can be scheduled to minimize noise disturbance.

- Designate a "disturbance coordinator" who would be responsible for responding to any complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., bad muffler, etc.) and will require that reasonable measures be implemented to correct the problem. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include in it the notice sent to neighbors regarding the construction schedule.

The implementation of the reasonable and feasible controls outlined above would reduce construction noise levels emanating from the site, minimizing disruption and annoyance. With the implementation of these controls, as well as the Municipal Code limits on allowable construction hours, and considering that construction is temporary, the impact would be reduced to a less-than-significant level.

Mitigation Measure 1a: No further mitigation required.

TABLE 7 Construction Equipment, 50-foot Noise Emission Limits

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes: [1] Measured at 50 feet from the construction equipment, with a "slow" (1 sec.) time constant.

[2] Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.

[3]Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

TABLE 8 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	II	I	II	I	II	I	II
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84

I - All pertinent equipment present at site.
II - Minimum required equipment present at site.

Source: U.S.E.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

TABLE 9 Estimated Construction Noise Levels at Nearby Land Uses During Phase I

Proposed Project Construction	Estimated Noise Levels at Nearby Land Uses, dBA L_{eq}				
	North Building B	Southwest Commercial	Southeast Residential	East Residential	Northeast County Bldg
Ground Clearing	66 dBA L_{eq} at 370 feet	64 dBA L_{eq} at 485 feet	69 dBA L_{eq} at 250 feet	65 dBA L_{eq} at 395 feet	69 dBA L_{eq} at 240 feet
Excavation	58 - 71 dBA L_{eq} at 370 feet	55 - 68 dBA L_{eq} at 485 feet	61 - 74 dBA L_{eq} at 250 feet	57 - 70 dBA L_{eq} at 395 feet	61 - 74 dBA L_{eq} at 240 feet
Foundations	64 dBA L_{eq} at 370 feet	61 dBA L_{eq} at 485 feet	67 dBA L_{eq} at 250 feet	63 dBA L_{eq} at 395 feet	67 dBA L_{eq} at 240 feet
Erection	48 - 64 dBA L_{eq} at 370 feet	45 - 61 dBA L_{eq} at 485 feet	51 - 67 dBA L_{eq} at 250 feet	47 - 63 dBA L_{eq} at 395 feet	51 - 67 dBA L_{eq} at 240 feet
Finishing	55 - 71 dBA L_{eq} at 370 feet	52 - 68 dBA L_{eq} at 485 feet	58 - 74 dBA L_{eq} at 250 feet	54 - 70 dBA L_{eq} at 395 feet	58 - 74 dBA L_{eq} at 240 feet

TABLE 10 Estimated Construction Noise Levels at Nearby Land Uses During Phase II

Proposed Project Construction	Estimated Noise Levels at Nearby Land Uses, dBA L_{eq}				
	North Building A	Northwest Kaiser Hsptl	West Residential	South Building C	East Courthouse
Ground Clearing	72 dBA L_{eq} at 185 feet	62 dBA L_{eq} at 545 feet	61 dBA L_{eq} at 605 feet	68 dBA L_{eq} at 285 feet	72 dBA L_{eq} at 185 feet
Excavation	64 - 77 dBA L_{eq} at 185 feet	54 - 67 dBA L_{eq} at 545 feet	53 - 66 dBA L_{eq} at 605 feet	60 - 73 dBA L_{eq} at 285 feet	64 - 77 dBA L_{eq} at 185 feet
Foundations	70 dBA L_{eq} at 185 feet	60 dBA L_{eq} at 545 feet	59 dBA L_{eq} at 605 feet	66 dBA L_{eq} at 285 feet	70 dBA L_{eq} at 185 feet
Erection	54 - 70 dBA L_{eq} at 185 feet	44 - 60 dBA L_{eq} at 545 feet	43 - 59 dBA L_{eq} at 605 feet	50 - 66 dBA L_{eq} at 285 feet	54 - 70 dBA L_{eq} at 185 feet
Finishing	61 - 77 dBA L_{eq} at 185 feet	51 - 67 dBA L_{eq} at 545 feet	50 - 66 dBA L_{eq} at 605 feet	57 - 73 dBA L_{eq} at 285 feet	61 - 77 dBA L_{eq} at 185 feet

TABLE 11 Estimated Construction Noise Levels at Nearby Land Uses During Phase III

Proposed Project Construction	Estimated Noise Levels at Nearby Land Uses, dBA L_{eq}				
	North Residential	West Kaiser Hsptl	East Residential	East Courthouse	South Building B
Ground Clearing	72 dBA L_{eq} at 170 feet	66 dBA L_{eq} at 345 feet	71 dBA L_{eq} at 195 feet	68 dBA L_{eq} at 295 feet	70 dBA L_{eq} at 230 feet
Excavation	64 - 77 dBA L_{eq} at 170 feet	58 - 71 dBA L_{eq} at 345 feet	63 - 76 dBA L_{eq} at 195 feet	60 - 73 dBA L_{eq} at 295 feet	62 - 75 dBA L_{eq} at 230 feet
Foundations	70 dBA L_{eq} at 170 feet	64 dBA L_{eq} at 345 feet	69 dBA L_{eq} at 195 feet	66 dBA L_{eq} at 295 feet	68 dBA L_{eq} at 230 feet
Erection	54 - 70 dBA L_{eq} at 170 feet	48 - 64 dBA L_{eq} at 345 feet	53 - 69 dBA L_{eq} at 195 feet	50 - 66 dBA L_{eq} at 295 feet	52 - 68 dBA L_{eq} at 230 feet
Finishing	61 - 77 dBA L_{eq} at 170 feet	55 - 71 dBA L_{eq} at 345 feet	60 - 76 dBA L_{eq} at 195 feet	57 - 73 dBA L_{eq} at 295 feet	59 - 75 dBA L_{eq} at 230 feet

TABLE 12 Estimated Construction Noise Levels at Nearby Land Uses During Construction of the Oak Avenue Extension Bridge

Proposed Project Construction	Estimated Noise Levels at Nearby Land Uses, dBA L_{eq}			
	SW Building C	SE Residential	NE Residential	NW Commercial
Ground Clearing	78 dBA L_{eq} at 100 feet	84 dBA L_{eq} at 50 feet	75 dBA L_{eq} at 140 feet	74 dBA L_{eq} at 155 feet
Excavation	72 - 82 dBA L_{eq} at 100 feet	78 - 88 dBA L_{eq} at 50 feet	69 - 79 dBA L_{eq} at 140 feet	68 - 78 dBA L_{eq} at 155 feet
Foundations	82 dBA L_{eq} at 100 feet	88 dBA L_{eq} at 50 feet	79 dBA L_{eq} at 140 feet	78 dBA L_{eq} at 155 feet
Erection	72 - 73 dBA L_{eq} at 100 feet	78 - 79 dBA L_{eq} at 50 feet	69 - 70 dBA L_{eq} at 140 feet	69 - 68 dBA L_{eq} at 155 feet
Finishing	78 dBA L_{eq} at 100 feet	84 dBA L_{eq} at 50 feet	75 dBA L_{eq} at 140 feet	74 dBA L_{eq} at 155 feet

Impact 1b: **Permanent Noise Level Increase.** The proposed project would not result in a substantial permanent noise level increase due to project-generated traffic at the existing noise-sensitive land uses in the project vicinity. **This is a less-than-significant impact.**

A significant impact would occur if the permanent noise level increase due to project-generated traffic was 3 dBA CNEL or greater for future noise levels exceeding 60 dBA CNEL or was 5 dBA CNEL or greater for future noise levels at or below 60 dBA CNEL. The ambient measurements made for the proposed project indicate that existing noise levels at the noise-sensitive receptors located in the project vicinity exceed 60 dBA CNEL; therefore, a significant impact would occur if project-generated traffic increased levels by 3 dBA CNEL or more. For reference, a 3 dBA CNEL

noise increase would be expected if the project would double existing traffic volumes along a roadway.

A traffic study was completed for the El Camino Real/Chestnut Avenue Area Plan Draft Traffic Impact Analysis.[2] By comparing the peak hour volumes for the existing plus project scenario to the existing volumes for each intersection included in the report, the noise level increase due to the Area Plan, which included the proposed project, was calculated to be 1 dBA CNEL or less along each roadway segment in the project site vicinity. Additionally, peak hour trips generated by the proposed project were also provided for this study.[7] The peak hour trips estimated for the project were less than those included for the entire Area Plan. Therefore, the proposed project would not result in a 3 dBA increase in noise levels at receptors in the project vicinity. This impact is a less-than-significant impact.

Mitigation Measure 1b: None required.

Impact 1c: Noise Levels in Excess of Standards. The proposed project could potentially generate noise in excess of standards established in the City's Municipal Code at the nearby sensitive receptors. The incorporation of measures to reduce noise levels generated by mechanical equipment and truck loading activities as project conditions of approval would result in a **less-than-significant** impact.

Mechanical Equipment Noise

The proposed project would include mechanical equipment, such as heating, ventilation, and air conditioning systems. Information regarding the number, type, size, location, and noise level data of the mechanical equipment units to be used in the proposed project was not available at the time of this study. Typically, mechanical equipment at these mixed-use buildings would be located with the parking structure or electrical rooms and on the rooftops.

This type of mechanical equipment would typically run continuously during the daytime and nighttime hours. Section 8.32.030 of the City's Municipal Code limits noise levels at multi-family residences and mixed-use residential land uses to 60 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and to 55 dBA at night (10:00 p.m. to 7:00 a.m.) for any noise source operating for 30 minutes or more in any given hour. For single-family residences and duplexes, the daytime threshold would also be 60 dBA, while the nighttime threshold would be 50 dBA. Additionally, the City defines a nighttime threshold of 60 dBA for commercial properties within specific plan districts.

Without knowing specific information such as the number and types of units, size, housing specifications, source noise levels, and precise locations, the impact of mechanical equipment noise on nearby noise-sensitive uses cannot be assessed at this time. Conservatively, mechanical equipment noise for the proposed project has the potential to exceed the City's daytime noise threshold of 60 dBA at the nearby residential properties and the nighttime thresholds of 50 and 55 dBA uses at single-family and multi-family properties, respectively. The nighttime threshold of 60 dBA at commercial properties could also potentially be exceeded.

[7] CEQA Transportation Impact Analysis Assessment for the SFPUC Site, December 5, 2018.

Mechanical equipment shall be selected and designed to reduce impacts on surrounding uses to meet the City's noise level requirements. A qualified acoustical consultant shall be retained to review mechanical noise, as these systems are selected, to determine specific noise reduction measures necessary to reduce noise to comply with the City's noise level requirements. Noise reduction measures could include, but are not limited to, selection of equipment that emits low noise levels and/or installation of noise barriers, such as enclosures and parapet walls, to block the line-of-sight between the noise source and the nearest receptors. Alternate measures may include locating equipment in less noise-sensitive areas, where feasible. With the incorporation of measures to reduce noise levels to be compliant with the City's requirements as project conditions of approval, this would be a less-than-significant impact.

Truck Loading and Unloading

Truck deliveries from the commercial land uses proposed on the project site would have the potential to generate noise. Loading areas were not identified on the site plan provided at the time of this study. However, the most likely loading zones would be located along Oak Avenue near the market hall or within the parking garages.

Typical deliveries would take approximately 15 minutes or less, which means the City would require loading and unloading activities be at or below 65 dBA during daytime hours at the residential and commercial land uses surrounding the site. It is assumed that deliveries would only occur between 7:00 a.m. and 10:00 p.m.; therefore, the nighttime thresholds would not apply for deliveries.

If the loading zones would be located within the parking structures, then all surrounding land uses would be shielded from delivery truck noise, which would result in a less-than-significant impact. Assuming loading zones to be located along Oak Avenue, the residences to the south would have direct line-of-sight to truck delivery noise. The distance from the nearest potential delivery zone to the property line of the southern residences would be approximately 70 feet.

Based on the size of the proposed commercial space, smaller delivery and vendor would be expected at the project site. These trucks typically would generate maximum noise levels of 65 to 70 dBA at a distance of 50 feet. Using a 6 dBA per doubling of the distance propagation rate, the noise levels due to deliveries at the nearest residences would range from 62 to 67 dBA, which would potentially exceed the 65 dBA daytime requirement.

All other nearby land uses would be 250 feet or more from the potential Oak Avenue delivery zone. At this distance, noise levels would range from 51 to 56 dBA. Therefore, loading and unloading activities would only potentially exceed the City's thresholds at the nearest residences to the south, assuming a curbside delivery zone along Oak Avenue.

Additionally, the effect of loading zone activities on the on-site sensitive land uses would need to be evaluated for noise impacts once project-specific information, such as type and size of the retail uses, hours of operation, and frequency of deliveries, is available.

Due to the close proximity of the potential loading area along Oak Avenue to the existing noise-sensitive land uses, noise impacts would be reduced with the implementation of the following measures:

- Move loading zones inside (e.g., within parking structures), where possible, or as far from adjacent residential and commercial uses as possible.

- Implement a no idling policy at all locations that requires engines to be turned off after five minutes.

- Recess truck docks into the ground.

- Equip loading bay doors with rubberized gasket type seals to allow little loading noise to escape, where possible.

The incorporation of these measures as project conditions of approval would reduce a potential noise impact to a less-than-significant level.

Mitigation Measure 1c: No further mitigation required.

Impact 2: Exposure to Excessive Groundborne Vibration. Construction-related vibration caused by some types of construction activity could be in excess of 0.3 in/sec PPV at the existing residences located adjacent to the project site. **This is a potentially significant impact.**

The construction of the project may generate perceptible vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams) are used. Construction activities would include site demolition, preparation work, foundation work, and new building framing and finishing. The proposed project would not require pile driving, which can cause excessive vibration.

The California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, which typically consist of buildings constructed since the 1990s. A conservative vibration limit of 0.3 in/sec PPV has been used for buildings that are found to be structurally sound but where structural damage is a major concern (see Table 3 above for further explanation). For historical buildings or buildings that are documented to be structurally weakened, a cautious limit of 0.08 in/sec PPV is often used to provide the highest level of protection. No historical buildings or buildings that are documented to be structurally weakened adjoin the project site. For the purposes of this study, groundborne vibration levels exceeding the conservative 0.3 in/sec PPV limit at the existing adjacent residences would have the potential to result in a significant vibration impact.

Table 13 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.) may generate substantial vibration in the immediate vicinity. Vibration levels would vary depending on soil conditions, construction methods, and equipment used.

For the construction of the proposed buildings, most of the construction activity would occur at the location of the buildings; however, due to the plazas and other public outdoor areas proposed at the site, heavy equipment usage could occur along the site boundaries. To the north, an existing apartment building would potentially be as close as 15 feet from the shared property line. Additionally, the existing BART buildings located on the project site, which would remain in the future, would also be approximately 15 feet from the nearest construction activity. At this distance, equipment such as clam shovel drops and vibratory rollers could generate vibration levels of 0.36 to 0.37 in/sec PPV, which would exceed the 0.3 in/sec PPV threshold. All other construction equipment would generate vibration levels below the 0.3 in/sec PPV threshold.

All other surrounding buildings would either be opposite El Camino Real, the creek, or Mission Road. These buildings would be 80 feet or more from the active construction site. At this distance, vibration levels would be 0.06 in/sec PPV or below.

Additionally, construction of the proposed Oak Avenue extension bridge would potentially require the use of heavy vibration-generating equipment as close as 45 feet from the nearest sensitive building. At this distance, vibration levels would be up to 0.11 in/sec PPV. All other future and existing buildings would be over 80 from the proposed bridge work, with vibration levels below 0.058 in/sec PPV.

Construction activity for the proposed project could potentially result in cosmetic damage to the residences and commercial buildings adjacent to the active construction areas. The following measures shall be incorporated as project conditions of approval where vibration levels due to construction activities would exceed 0.3 in/sec PPV at nearby sensitive uses:

- Comply with the construction noise ordinance to limit hours of exposure. The City's Municipal Code allows construction activities between the hours of 8:00 a.m. and 8:00 p.m. Monday through Friday, from 9:00 a.m. to 8:00 p.m. on Saturdays, and between 10:00 a.m. and 6:00 p.m. on Sundays and holidays.

- The project contractor shall avoid using vibratory rollers and packers near sensitive areas, such as the northern property line and near the existing BART buildings, whenever possible.

- Prohibit the use of heavy vibration-generating construction equipment, such as vibratory rollers or clam shovel drops, within 20 feet of any adjacent sensitive land use, where feasible.

- The contractor shall alert heavy equipment operators to the close proximity of the adjacent structures so they can exercise extra care.

- The contractor shall retain a qualified firm to conduct a pre- and post-construction cosmetic crack survey of the buildings adjacent to the southern and western boundaries and shall repair any additional cosmetic cracking.

Critical factors pertaining to the impact of construction vibration on sensitive receptors include the proximity of the existing structures to the project site, the soundness of the structures, and the methods of construction used. The implementation of these mitigation measures would reduce a potential impact to a less-than-significant level.

TABLE 13 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)
Pile Driver (Impact)	upper range	1.158
	typical	0.644
Pile Driver (Sonic)	upper range	0.734
	typical	0.170
Clam shovel drop		0.202
Hydromill (slurry wall)	in soil	0.008
	in rock	0.017
Vibratory Roller		0.210
Hoe Ram		0.089
Large bulldozer		0.089
Caisson drilling		0.089
Loaded trucks		0.076
Jackhammer		0.035
Small bulldozer		0.003

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

Mitigation Measure 2: No further mitigation required.

Impact 3: Excessive Aircraft Noise. The project site is located more than two miles of a public airport or public use airport and would not expose people residing or working in the project area to excessive noise levels. **This is a less-than-significant impact.**

San Francisco International Airport is a public-use airport located approximately 2.8 miles southeast of the project site. Although aircraft-related noise would be audible at the project site, noise from aircraft would not substantially increase ambient noise levels. The project site lies outside the 2020 65 dBA CNEL noise contours shown in Exhibits IV-5 and IV-6 of the Comprehensive Airport Land Use Compatibility Plan for the Environs of San Francisco International Airport.[8] Exterior and interior noise levels resulting from aircraft would be compatible with the proposed project.

Mitigation Measure 3: None required.

[8] Ricondo & Associates, in association with Jacobs Consultancy and Clarion Associates, "Draft Comprehensive Airport Land Use Compatibility Plan for the Environs of San Francisco International Airport," July 2012.